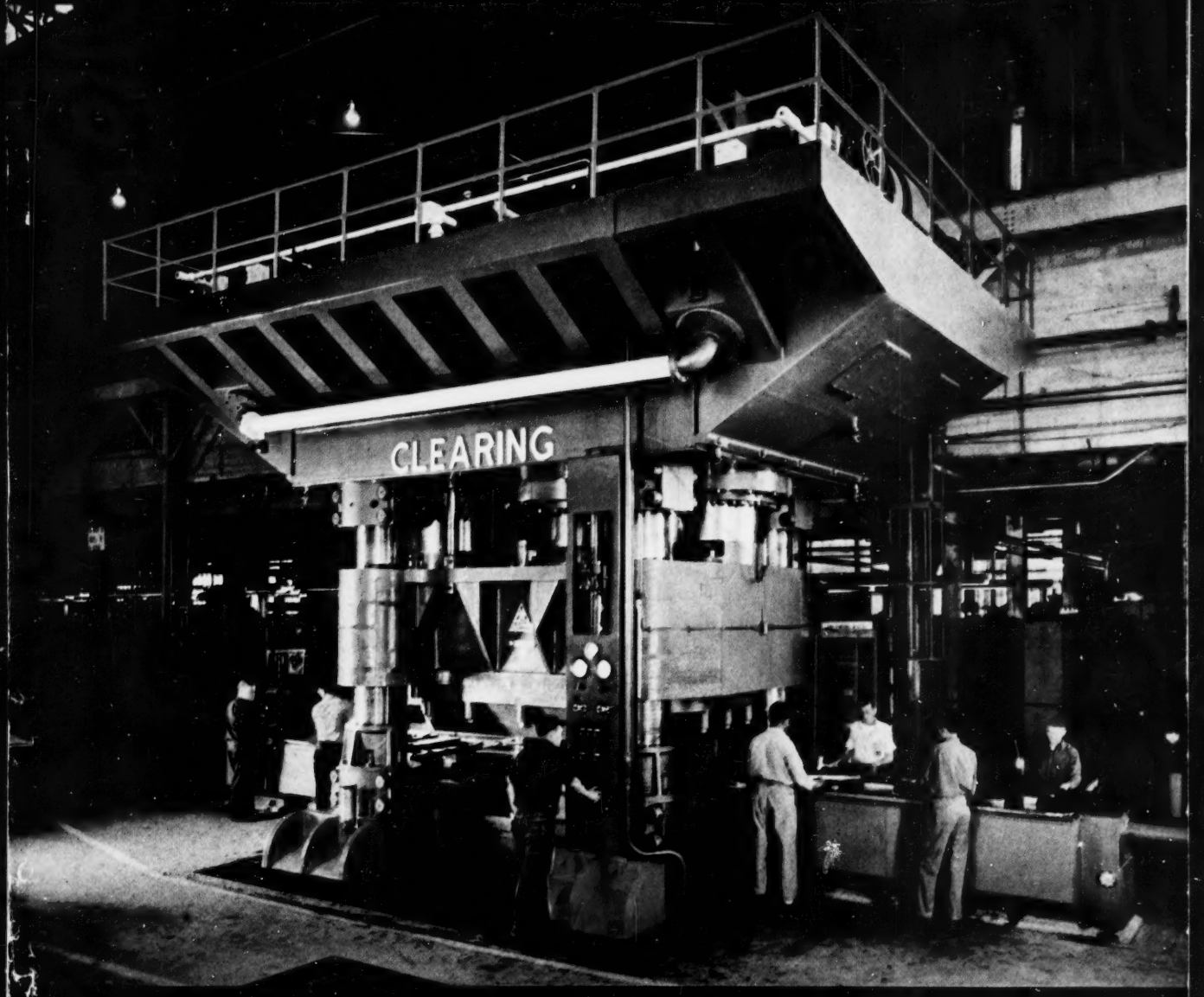
14th AIRCRAFT PRODUCTION NUMBER — JULY 1954

MACHINERY



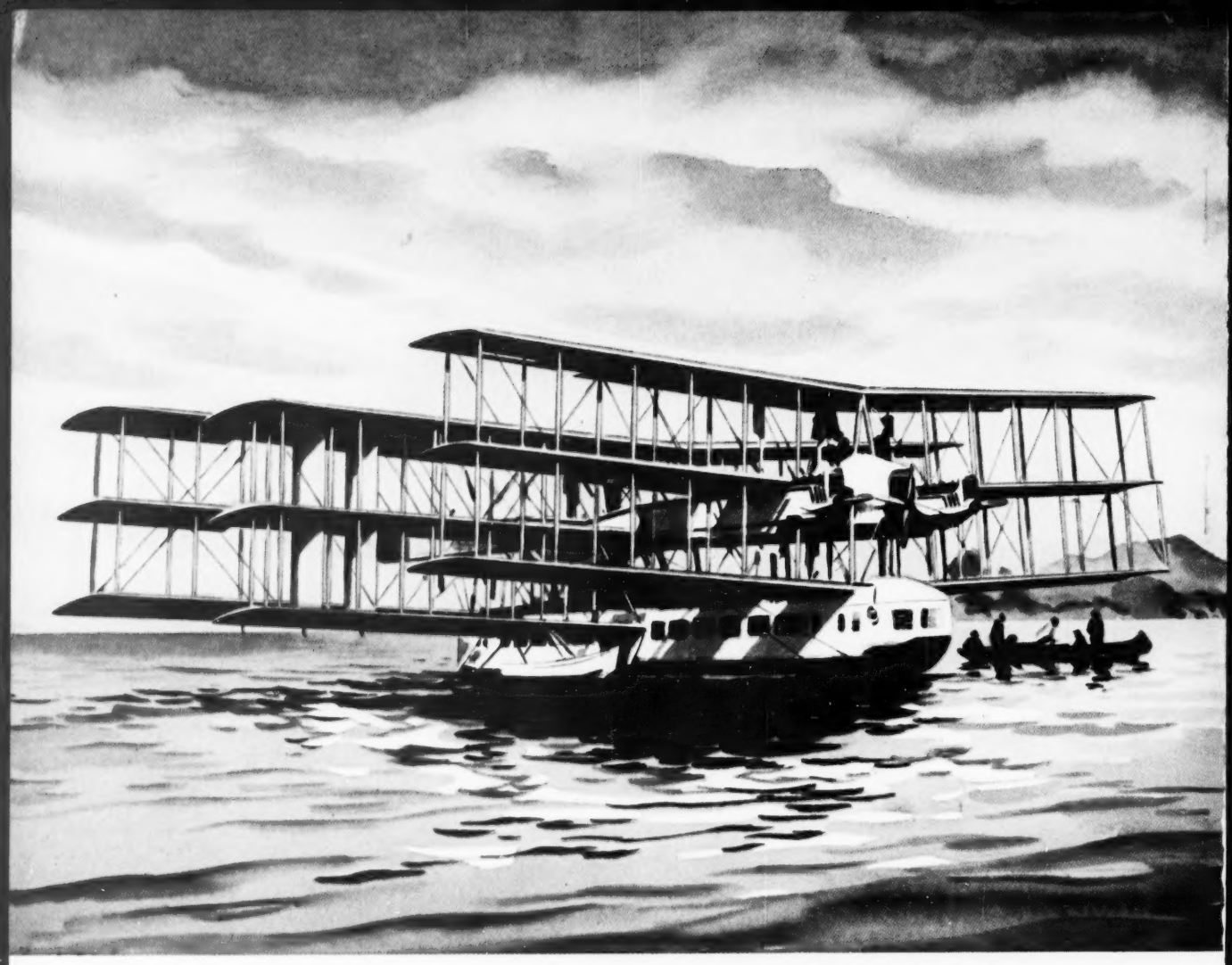
CLEARING Puts 7,000 Tons Behind a Soft Squeeze

This 7,000 ton Clearing hydraulic press at the Oliver Corporation in Battle Creek, Michigan, has a rubber pad in the ram which replaces one-half of the die sections normally needed. Squeezing finished parts to shape in this manner has solved the die cost problems on the more than 150 parts made on this press. Automatic feeding tables expedite loading and unloading. If you'd like to put the squeeze on rising manufacturing costs, get in touch with Clearing Machine Corporation.

CMC

CLEARING PRESSES THE WAY TO EFFICIENT MASS PRODUCTION

CLEARING MACHINE CORPORATION ★ 6496 West 65th Street • Chicago 38, Illinois ★ Hamilton Division, Hamilton, Ohio



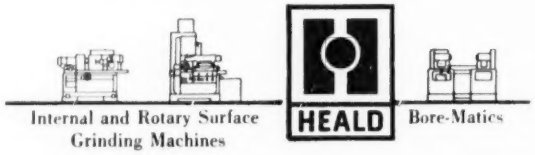
This one looked great . . . on paper

For all its nine wings and eight engines, the 25-ton "Epocha," built over 30 years ago by the Caproni Brothers, never got off the water. It *might have*—but it was destroyed by fire before the first test flight. Success or failure? The world will never know. Yet multiple wing types, favored by many early designers, are just memories now—left far behind in the competitive struggle for existence.

Competition is a mighty strong force today. Because of it, manufacturers everywhere are seeking new ways of improving product quality and cutting manufacturing cost. That's where we come in. For precision finishing on Heald machines can often make substantial savings in production time—help build a better, longer-lasting product, too.

Your Heald precision finishing specialist will be glad to show you how the latest developments in automation, way-type and transfer Bore-Matics, new grinding methods and interchangeable tooling can be applied to advantage on your production line.

Competition is wonderful if you're *ahead* of it. Our business is to help keep you there. That's why It Pays to Come to Heald.



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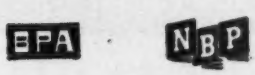

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The Monthly Magazine of Engineering and Production in the Manufacture of Metal Products

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3/8" Machine

threads 500 pieces per hour

THE WORLD'S LARGEST MANUFACTURERS OF THREADING EQUIPMENT

A LANDIS 3/8" Threading Machine has increased the output of threaded automobile seat lock rods by 25%.

#10 24-pitch UN threads are cut 1¾" long on 54" galvanized wire rods. Production now averages about 500 pieces per hour, with 4,500 pieces threaded between grinds of the chasers. With excellent production between chaser grinds, low tool cost and minimum downtime are assured through the use of long-life LANDIS Tangential Chasers which can be reground for 80% of their original length.

These savings are being realized at Mid-West Wire Products in Detroit, Michigan. Best previous threading methods never produced more than 400 pieces per hour, and completed only 2,500 pieces before requiring the chasers to be reground.

The 3/8" Machine is a small high-speed machine for threading small parts (3/16" to 1/2" in diameter) to precision tolerances. This machine has been designed so that it can be operated with only one hand, freeing the other hand for loading and unloading the workpiece. The opening and closing of the grips is automatically controlled by the carriage operating lever, and the die head automatically opens on completion of the thread and closes during the carriage return.

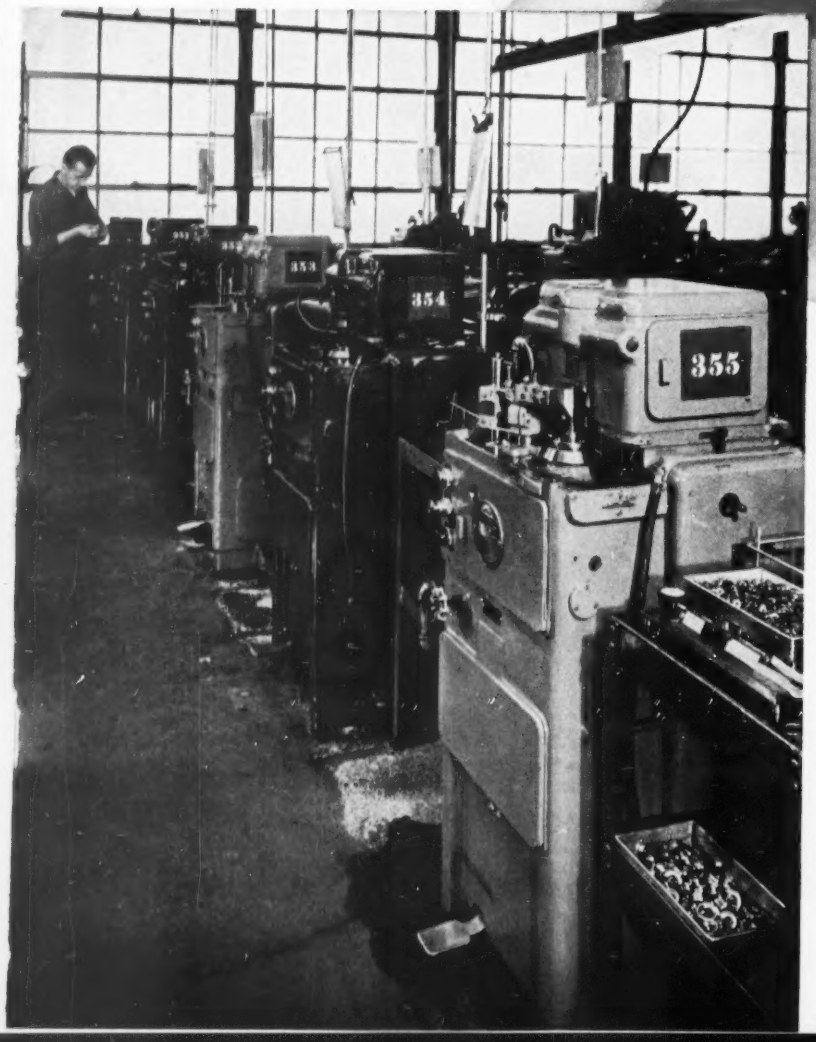
Analyze the threading operations in your plant today for the possibility of a similar production saving. Then send us the specifications of the workpiece involved, and ask for Bulletin H-91 for more detailed information about the LANDIS 3/8" High Speed Threading Machine.

LANDIS Machine COMPANY
WAYNESBORO
PENNA., U.S.A.

282-2-C

CUTTING - TAPPING - GRINDING - ROLLING

REVERE STEREO



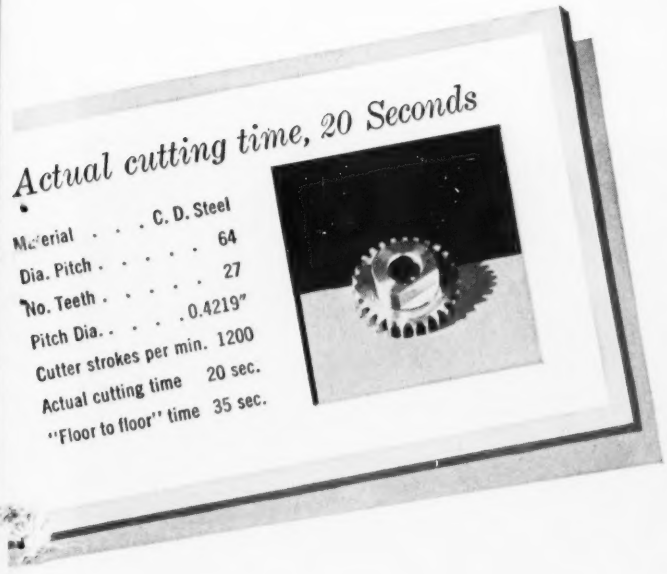
THE *Fellows*

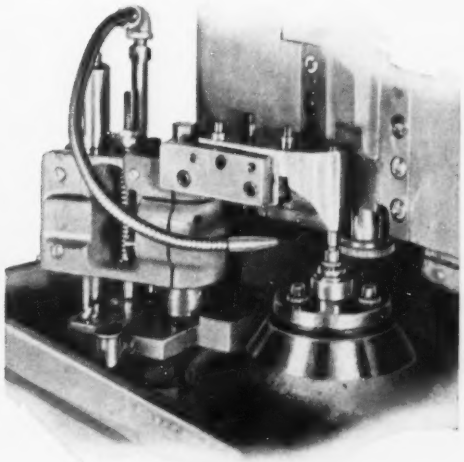
demands high-speed gear cutting

PRODUCTION schedules at Revere Camera's big Chicago plant are under pressure. 3-D slides and the REVERE STEREO camera are currently in exceptional demand.

So much so that over 30% of the output of their battery of Fellows Fine-Pitch Gear Shapers is at present concentrated on stereo camera parts. Various film feed, focus and shutter parts are turned out. One, in slightly magnified scale, is pictured and detailed below. Cutting is a typical Fellows high-speed operation.

Revere rightly expects top quality performance from its Gear Shapers—and gets it. So will any precision shop which pins its faith to the Fellows Method. Capacities of the several types of Gear Shapers range from 1/16 inch to 120 inches. A Fellows Sales Engineer can give you cost and performance data on the type best suited to your job. Write, wire or phone the nearest office.


Actual cutting time, 20 Seconds
Material . . . C. D. Steel
Dia. Pitch 64
No. Teeth 27
Pitch Dia. . . . . 0.4219"
Cutter strokes per min. 1200
Actual cutting time 20 sec.
"Floor to floor" time 35 sec.



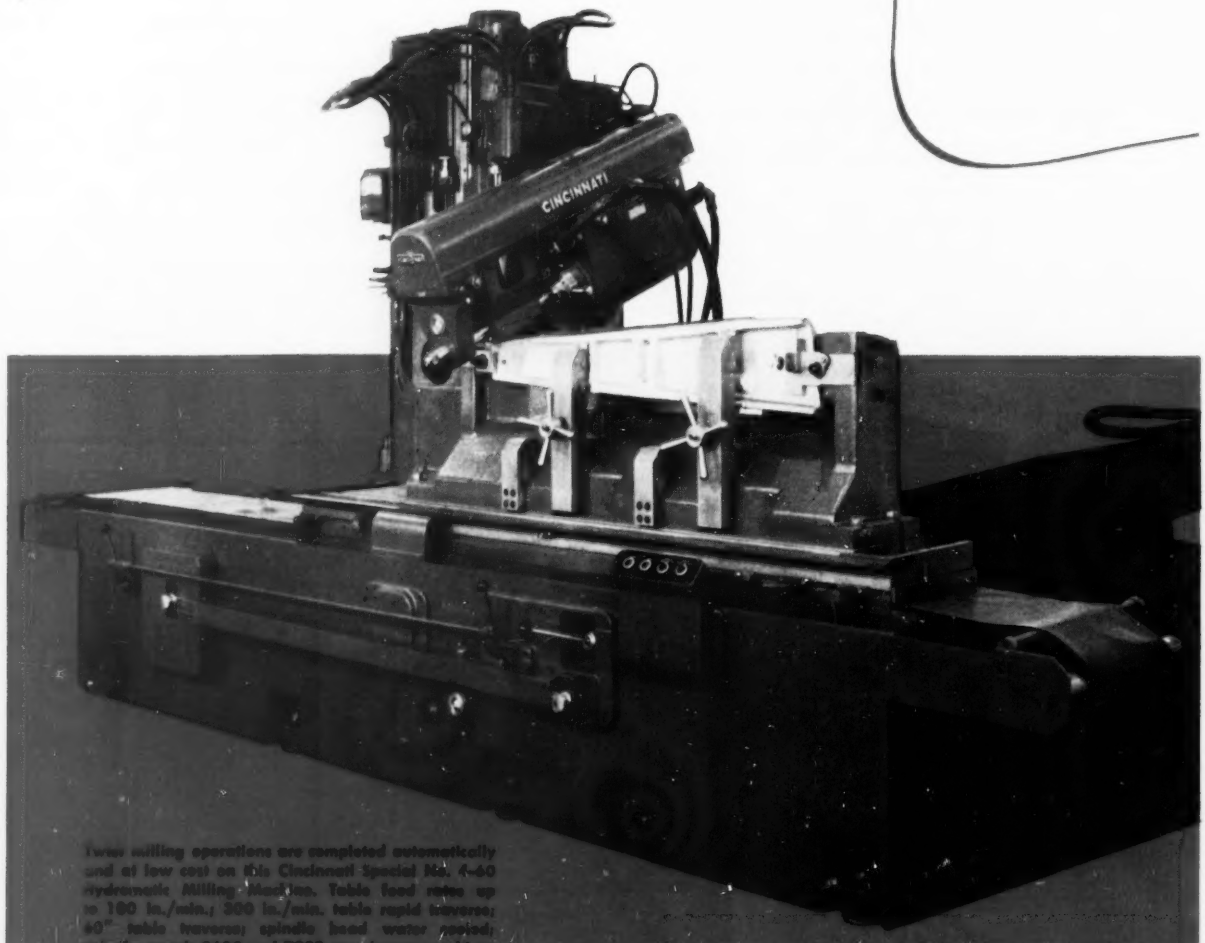
Fellows 3" Fine-Pitch Gear Shaper cutting stop gear for Revere Model 33 Stereo in 35 seconds 'floor to floor'.

GEAR SHAPER COMPANY

Head Office and Export Department, Springfield, Vermont.
Branch Offices: 319 Fisher Building, Detroit 2, Michigan • 5835 West North Avenue, Chicago 39, Illinois • 2206 Empire State Building, New York 1, N. Y.

CINCINNATI

A NEW Twist In Milling Airframe

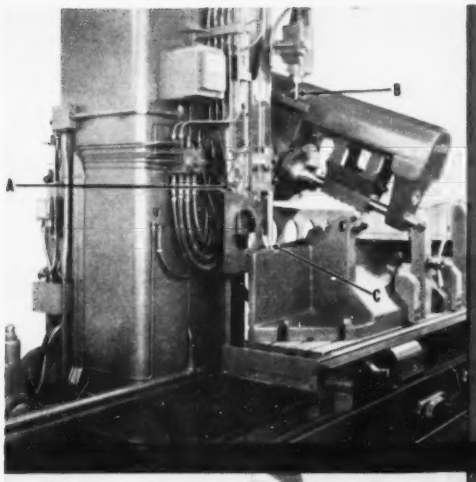


Twin milling operations are completed automatically and at low cost on this Cincinnati Special No. 4-60 Hydromatic Milling Machine. Table feed rates up to 180 in./min.; 300 in./min. table rapid traverse; 60" table traverse; spindle head water cooled; spindle speeds 3400 and 7730 rpm. Longer machines available up to 168" table traverse.

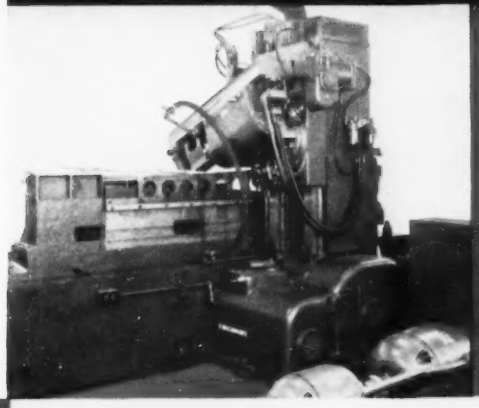
MILLING MACHINES • CUTTER SHARPENING MACHINES • BROACHING MACHINES • METAL FORMING MACHINES • FLAME HARDENING MACHINES OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

CINCIN

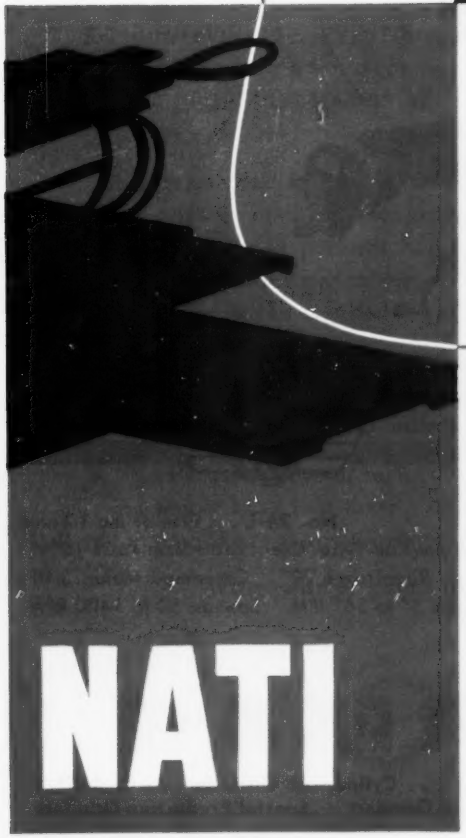
Sections



This view shows the hydraulic tracing units which control the vertical and angular "feed" of the spindle carrier to produce a twist milling operation.



Swivel mounting of the spindle carrier, with its integral motor and hose connections for water cooling, are evident in this illustration.



NATI

A manufacturer of aluminum airframe sections wanted a low-cost way to machine a profile with a twist on one edge of the part. Cincinnati Milling was asked to find a solution to the problem, and quickly saw a way to do the job. Cincinnati's engineers recommended a production type milling machine incorporating several units from standard machine tools, including automatic hydraulic tracing control for two feeding motions . . . vertical and angular. The idea was immediately accepted. Two close-up illustrations of the rear of the machine show the principle of operation. As the table traverses, tracing elements "A", "B" and "C" operate simultaneously to automatically control the angular and vertical displacements of the spindle carrier unit, and produce the required profile with a twist on the upper edge of the part. ¶ Automatic hydraulic tracing control is a familiar cost-reducing technique to Cincinnati Milling engineers. They have applied it to Cincinnati Milling Machines in many ways to solve difficult machining operations. These men will be happy to work with you in designing and building machine tool equipment as a complete production package. May we hear from you?

Special Machine Tool Division

THE CINCINNATI MILLING MACHINE CO.

CINCINNATI 9, OHIO

...ONLY the New

VAN NORMAN Ram Type Millers

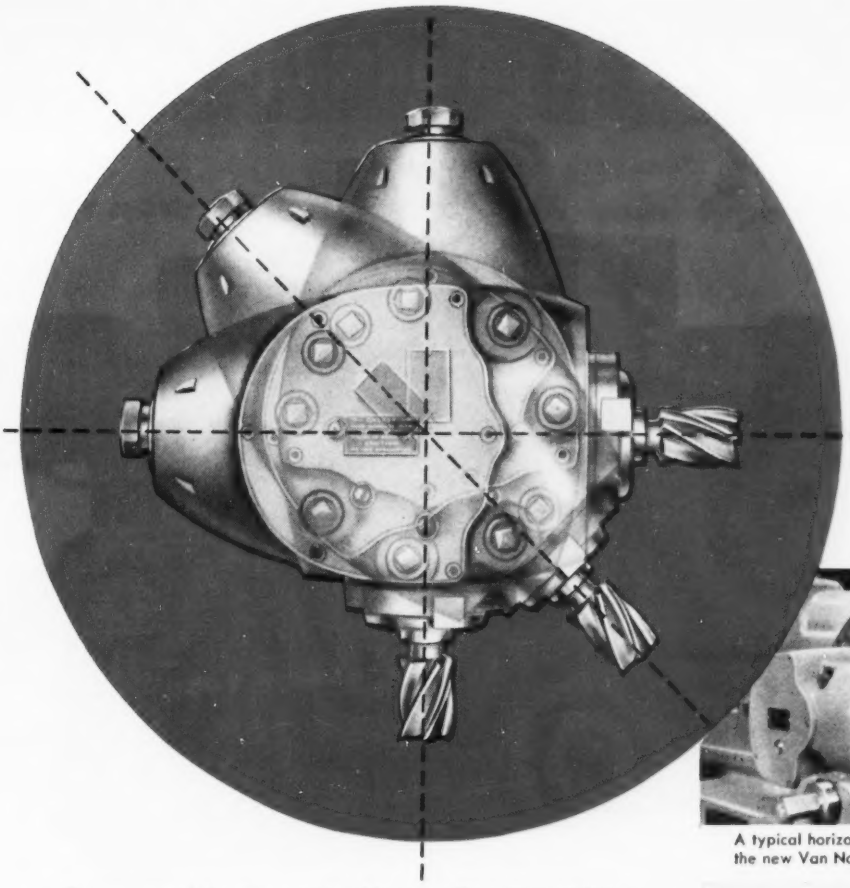
give you the exclusive advantages of the

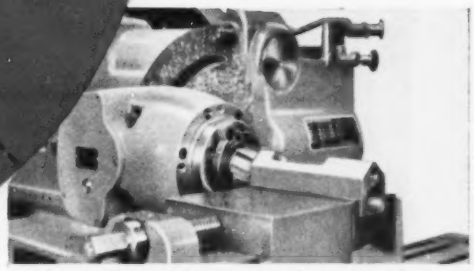
ADJUSTABLE CUTTERHEAD

No. 24-L . . . One of the 10 new Van Norman Ram Type Millers. Table Size: 45″ x 10½″. Ram Travel: 29″. Cutterhead Motor: 3 HP. Feeds: 5″ to 36″ IPM. Speeds: 50 to 1400 RPM.

VAN NORMAN

Manufactures Ram and Column Type Milling Machines . . . Cylindrical Grinders . . . Centerless Grinders . . . Spline and Gear Grinders . . . Oscillating Radius Grinders . . . Special Production Grinders





A typical horizontal milling operation performed on the new Van Norman Ram Type Miller.

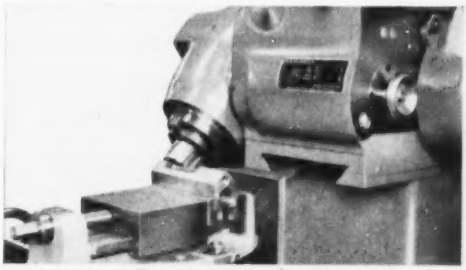
Every one of the *10 new* Van Norman Ram Type Millers give you the operating advantages of extra "*Flex-Ability*" and "*Cut-Ability*" that cut toolroom and production milling costs.

The exclusive adjustable cutterhead, mounted on the heavy-duty movable ram, provides maximum "*Flex-Ability*" . . . enables you to perform horizontal, angular and vertical milling with *one* miller . . . increase the work range that can be handled . . . reduce tooling costs.

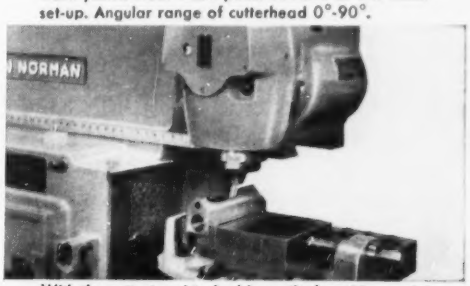
Extra "*Cut-Ability*" is assured through the new heavier columns and bases, larger knee, table and saddle assemblies, extra-heavy gears and spindle motors up to 10 HP.

Production, toolroom, laboratory or job shop . . . you simply can't beat these Van Norman Ram Type Millers for simplified set-ups, tooling and maximum output.

Write, wire or phone for complete details



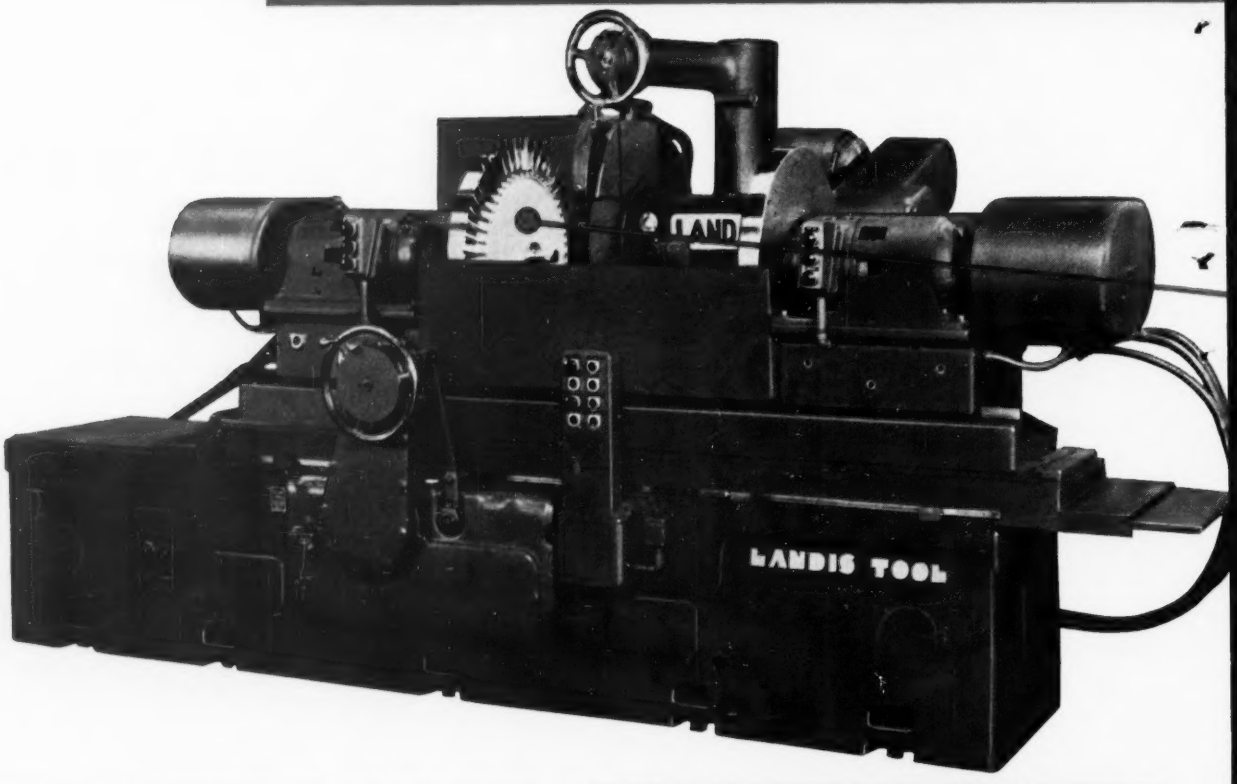
An angular milling operation performed on the same work piece. Note work piece remains in the same set-up. Angular range of cutterhead 0°-90°.



With the cutterhead locked in vertical position a slot is milled in the work piece. Note the set-up has not been changed.

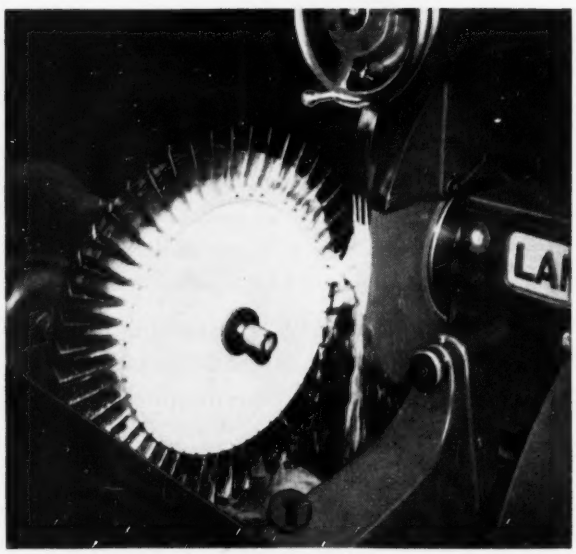
COMPANY | **SPRINGFIELD 7, MASSACHUSETTS**

Turbo Jet Blade Tip Grinding



Here is another example of a modern Landis precision grinder specially engineered to provide maximum output. This new 30" x 48" type CHW grinder has been equipped with dual work heads so the operator may load and unload workpieces on one head, while the other head is in grinding position.

job data	
OPERATION	Finish grinding Jet Compressor Blade Tips after assembly
DIAMETER OF WORK PIECE	30"
STOCK REMOVAL	.090" to .110" on diameter
FLOOR-TO-FLOOR TIME	10 minutes



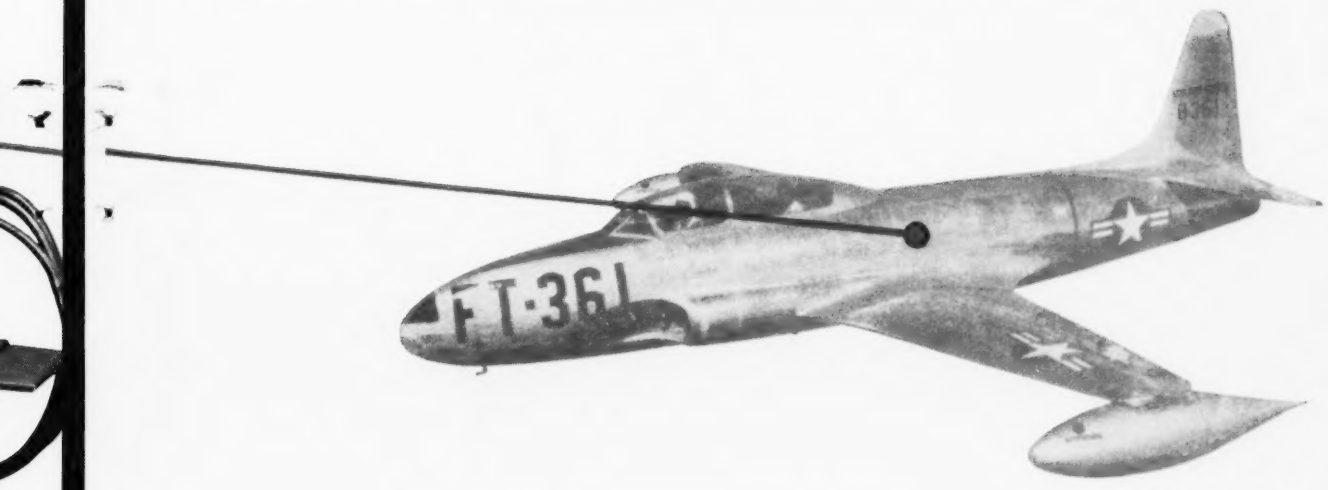
GRINDING ON LEFT-HAND WORK HEAD while operator loads or unloads workpiece on right-hand head.

LANDIS

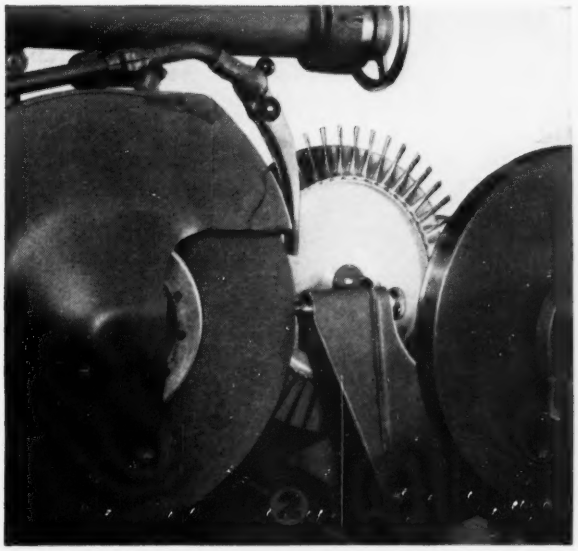
precision grinders

Output Doubled with Same Manpower

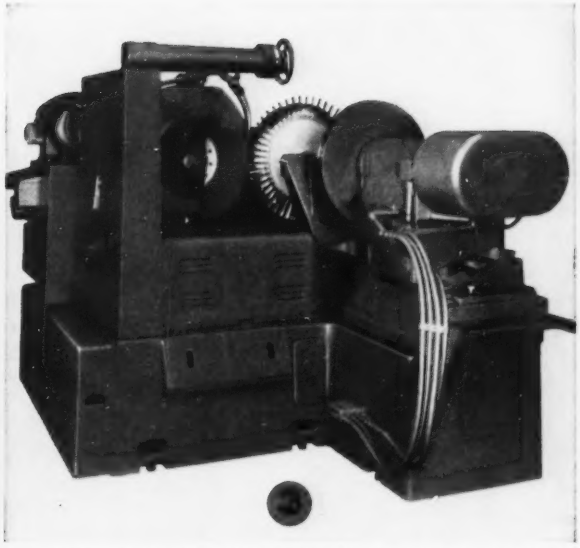
with new LANDIS dual work head type CHW grinders



Official U. S.
Air Force Photo



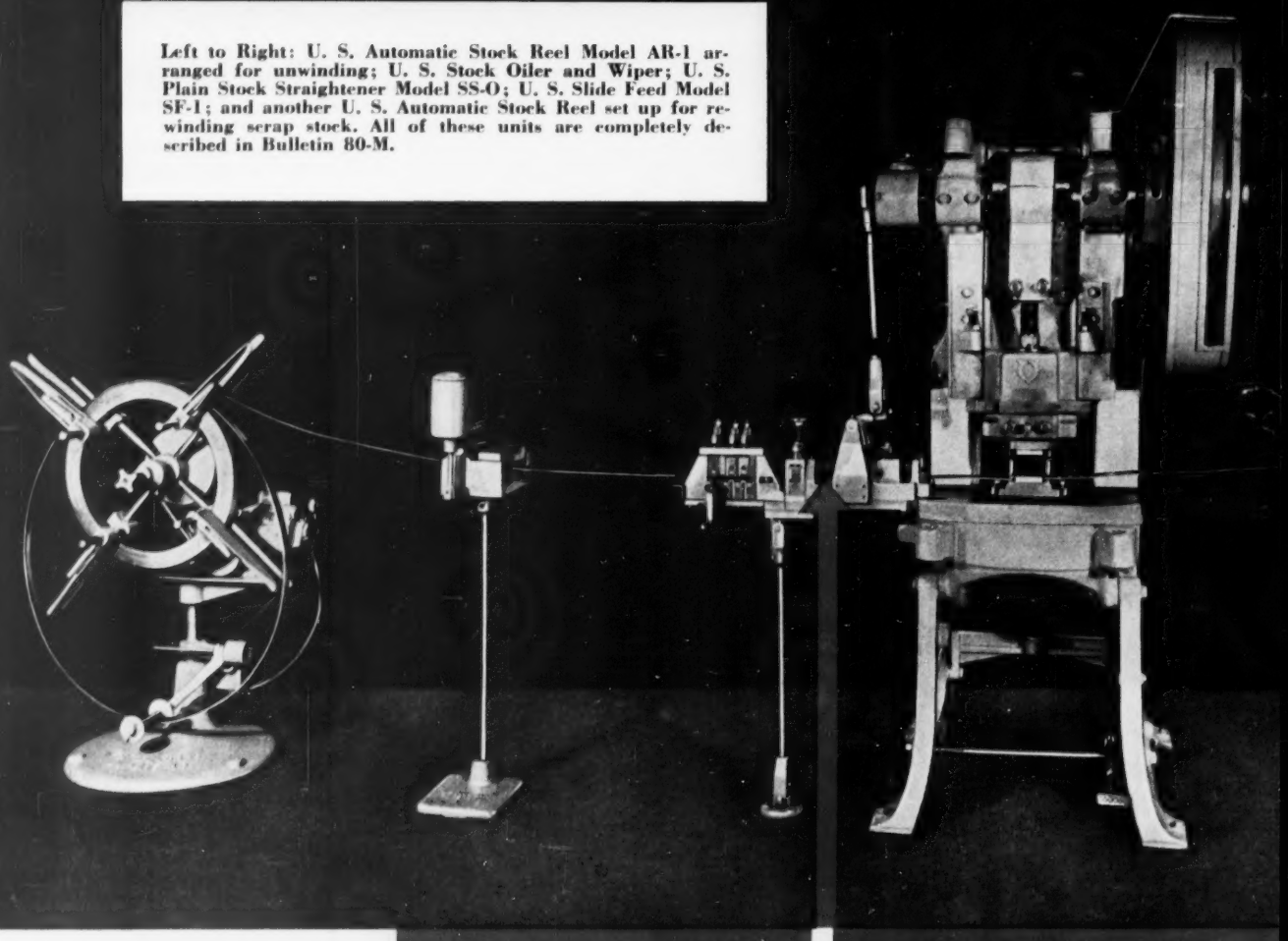
DRESSING BETWEEN GRINDS After grinding, wheel is dressed during slowdown of carriage while traversing to new grinding position.



GRINDING ON RIGHT-HAND HEAD Operator continues cycle by preparing workpiece for left-hand head.

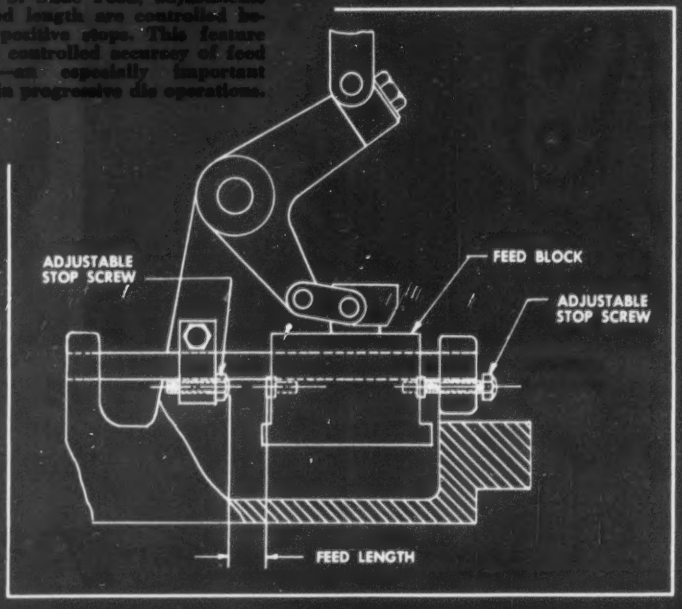
LANDIS TOOL COMPANY / WAYNESBORO, PENNA., U. S. A.

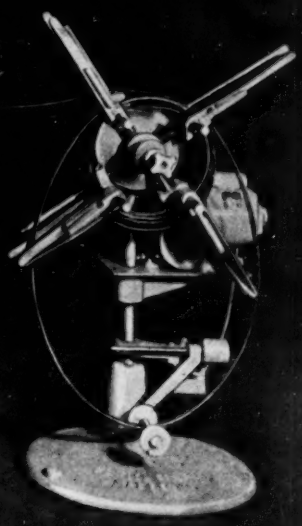
Left to Right: U. S. Automatic Stock Reel Model AR-1 arranged for unwinding; U. S. Stock Oiler and Wiper; U. S. Plain Stock Straightener Model SS-O; U. S. Slide Feed Model SF-1; and another U. S. Automatic Stock Reel set up for rewinding scrap stock. All of these units are completely described in Bulletin 80-M.



Positive Feed Length Adjustment

The drawing below shows how, in the U. S. Slide Feed, adjustments for feed length are controlled between positive stops. This feature assures controlled accuracy of feed length—an especially important factor in progressive die operations.





LOW COST AUTOMATION FOR YOUR PRESS ROOM

You can use U. S. Automatic Press Room Equipment to get all the advantages of automation at low cost. Illustrated is a typical set-up which converts a conventional punch press into an automatic machine by using two U. S. Automatic Stock Reels (one for unwinding the stock and one for rewinding it), a U. S. Stock Oiler and Wiper, a U. S. Plain Stock Straightener, and a U. S. Slide Feed.

A set-up like this gives you the double advantage of increased production and reduced labor costs, plus the added feature of flexibility. Within their capacity, all of the units shown can be easily adapted to handle materials varying in width, thickness and length of feed. Furthermore, U. S. Slide Feeds are designed so that the length of feed is controlled between positive stops, as shown in the drawing on the opposite page, providing consistent accuracy that is especially valuable in progressive die operations.

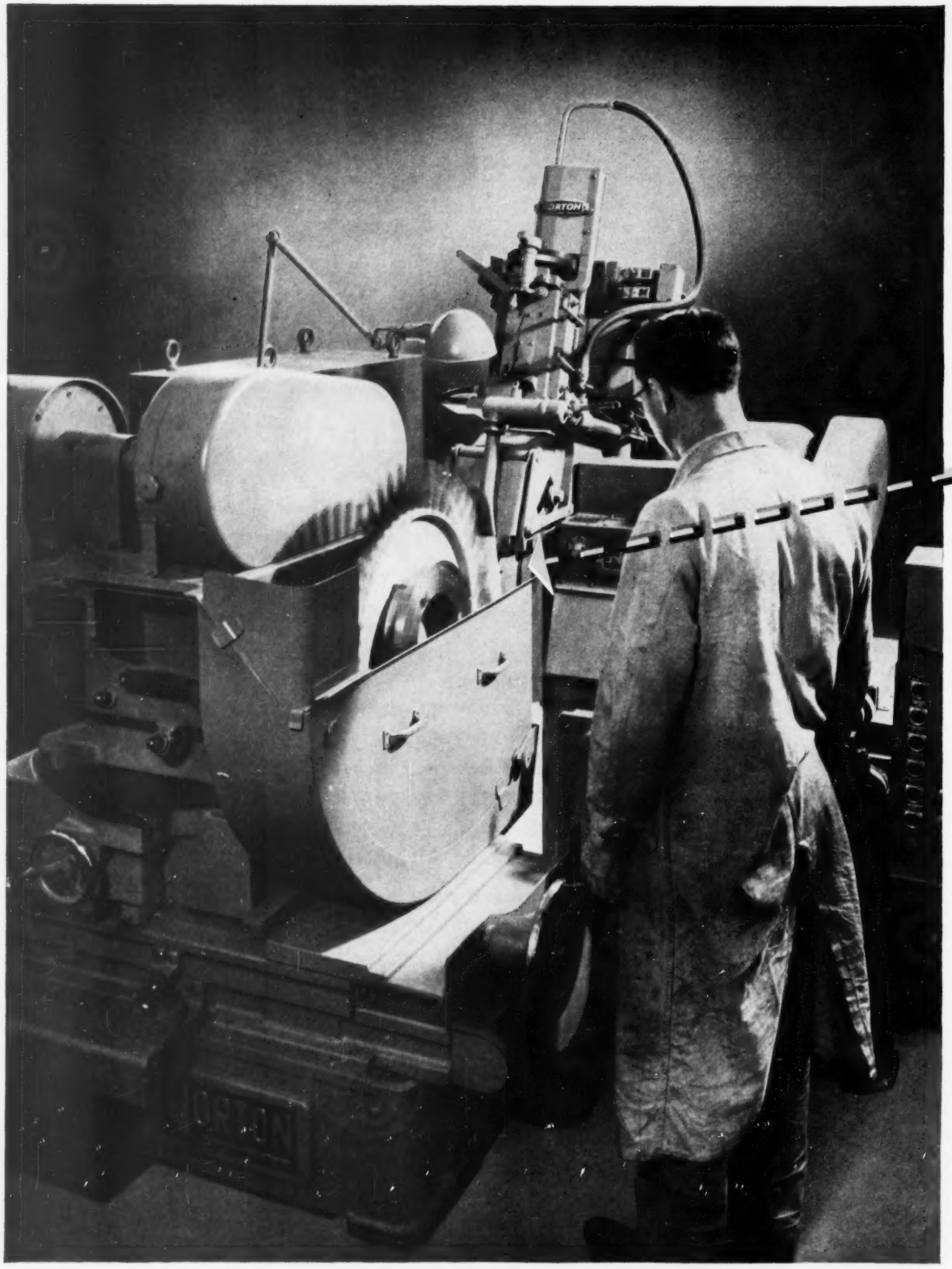
If you want to reduce costs and speed output in your press operations we suggest that you investigate the many advantages of U. S. Automatic Press Room Equipment. Bulletin 80-M gives essential facts about the complete line. Send for your copy.

U.S. TOOL COMPANY, Inc.

AMPERE (East Orange) NEW JERSEY

Builders of U. S. Multi-Slides—U. S. Multi-Millers

U. S. Automatic Press Room Equipment—U. S. Die Sets and Accessories



Grinding Short Parts With Large Diameters, like this compressor wheel, is a much faster and easier job on the Norton 42" Hi-Swing Semiautomatic Chucking Grinder. To the standard advantages of Norton semiautomatic design this machine adds many advanced features of its own for easier loading and unloading and faster, simplified operation. Results: less tiring work for your operators — a consistently higher production rate for *you*.

Now you can grind large diameter, short parts *fast!*

The Norton 42" Hi-Swing Semiautomatic Chucking Grinder features speed, adaptability and easy operation

For "Hi-Swing" in the name of the Norton 42" Hi-Swing Semiautomatic Chucking Grinder you can substitute "high speed," "high efficiency" or "high production" — and you'll be right every time!

Designed especially for rapid, accurate grinding of large diameter, short parts — such as jet engine compressor wheels and many similar components — it is particularly suited for jobs where both external and internal grinding are required. It takes work held by chucks, face plates or special fixtures and permits several surfaces to be ground without disturbing the set-up.

For easy operation

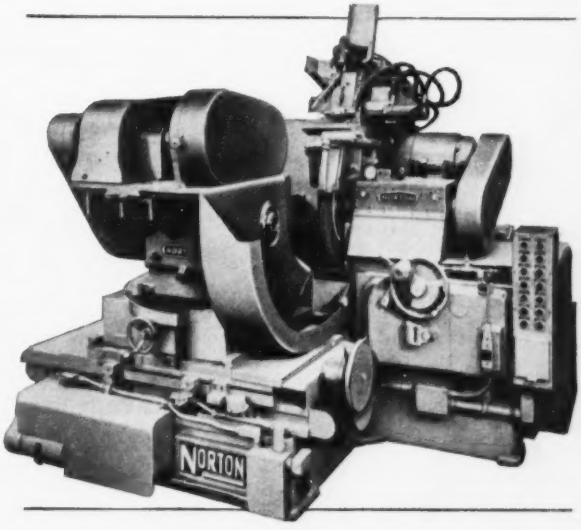
- Automatic or manual work rotation control by simple selector switch.
- Automatic or manual coolant flow control.
- Automatic feed cycle under one-lever control.
- Automatic wheel truing under push-button control.
- Excellent clearance conditions for loading and unloading.
- Maximum visibility of grinding action.
- All controls within easy reach of operator.
- Graduated wheel feed handwheel with "click-count" index.
- Power work head table traverse with automatic reverse by hydraulically operated rotating screw.

The automatic functions of the Hi-Swing Grinder combine to assure you a pre-determined, consistent rate of output. Advanced features like the wheel truing device greatly reduce the requirement of operating skill. And the careful consideration of the operator in the over-all design is still another factor that cuts down fatigue, saves time and enables continuous high production.

In your own plant

you'll find this pace-setting grinding machine a real profit-boosting production tool on many jobs that are now using up too much of your operators' time — and *your* money.

See your Norton Representative for further details on the 42" Hi-Swing Semiautomatic Chucking Grinder. Or write for Catalog. And remember: only Norton offers you such long experience on grinding wheels and machines to help you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Mass. *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5.



Designed For Easy Maintenance, the 42" Hi-Swing Grinder has all pumps, motors and filters mounted outside . . . pressure relief valves for hydraulic and ways lubrication systems conveniently placed . . . ways lubricant flow control valves at end of base . . . hinged wheel guard cover eases change . . . ramped coolant tank outlet speeds clean-cut . . . electrical controls in raised enclosure for stand-up inspection.

To Economize, Modernize With **NEW**

NORTON

GRINDERS and LAPPERS

Making better products . . . to make other products better

District Sales Offices:
Worcester • Hartford • New York • Cleveland • Chicago • Detroit

For more information on products advertised, use Inquiry Card, page 265

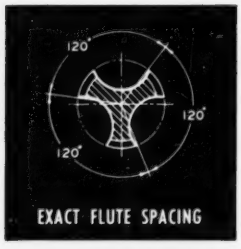
Two words that mean THE LAST WORD in the design and manufacture of taps:

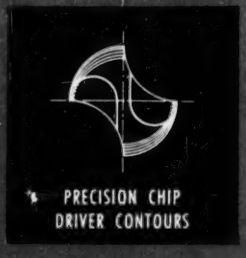
BALANCED Action

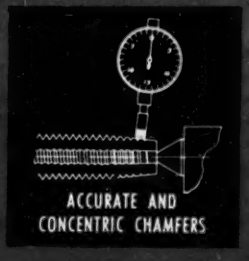
All Winter Taps—standard or special—are BALANCED ACTION TAPS. They give you size control and maximum tool life.

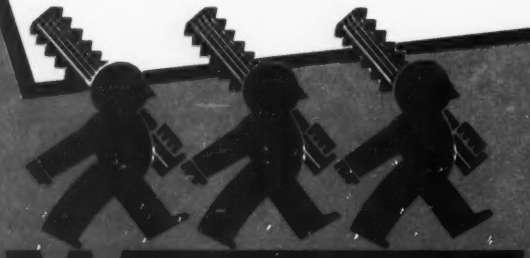
CALL YOUR WINTER DISTRIBUTOR

Your local Industrial Supply Distributor carries a complete stock of WINTER Balanced Action Taps.







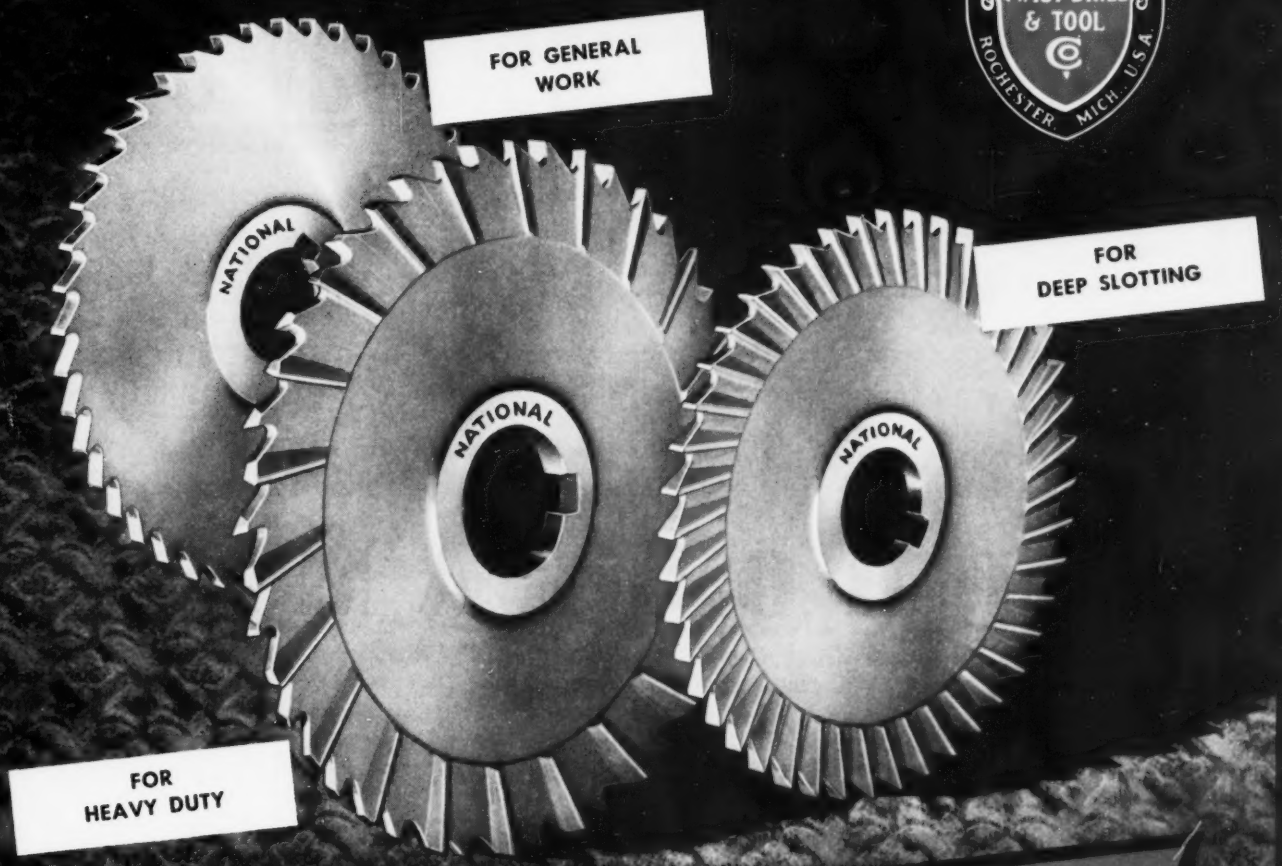


WINTER

WINTER BROTHERS COMPANY
Rochester, Michigan, U.S.A.
Distributors in principal cities. Branches in New York
Detroit • Chicago • Dallas • San Francisco • Los Angeles
Division of National Twist Drill & Tool Co.

National

NATIONAL TWIST DRILL & TOOL ROCHESTER, MICH. U.S.A.



For sawing and slotting . . . use NATIONAL CUTTING EDGES

Get the Saw with the bite that fits your job. You'll find it in the National line. All are designed to minimize fine chips and dust. No binding—no scoring.

NATIONAL TWIST DRILL AND TOOL COMPANY

Rochester, Michigan, U. S. A. Distributors in principal cities. Factory Branches: New York • Detroit • Chicago • Dallas • San Francisco • Los Angeles

CALL YOUR INDUSTRIAL SUPPLY DISTRIBUTOR for all your staple industrial needs, including NATIONAL Twist Drills, Reamers, Counterbores, Milling Cutters, End Mills, Hobs and Special Tools.

Machine selection in doubt? Here's a practical way out

Kearney & Trecker's

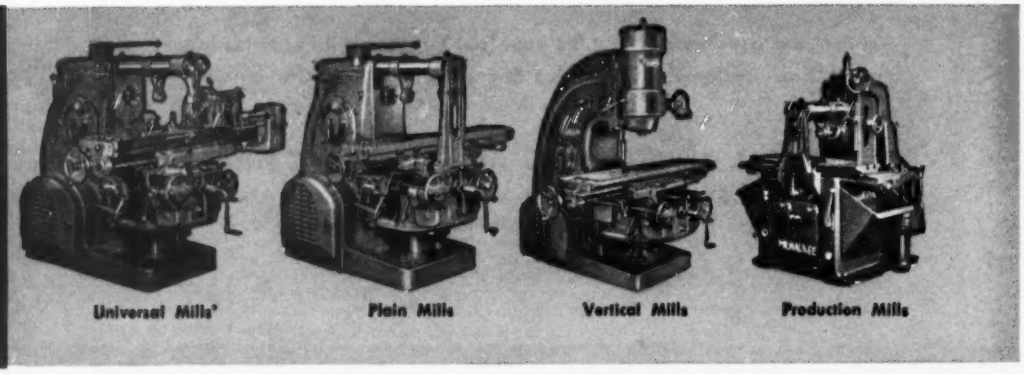
TOOL-LEASE

PROGRAM

•

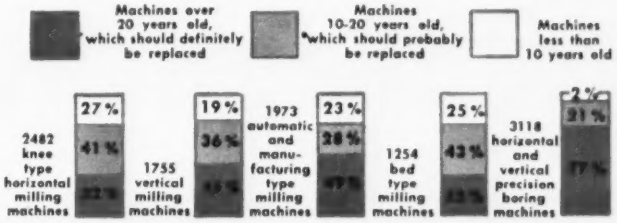
allows you to rent new machine tools...
literally try them before you buy them...
to be sure you get the flexibility you need
to meet changing competitive conditions

Kearney & Trecker manufactures a complete line of more than 250 standard knee and bed type milling machines and precision boring machines.



HERE'S WHAT THE OBSOLESCENCE PICTURE LOOKS LIKE IN THE MOTOR VEHICLES AND PARTS INDUSTRY

Here's the picture in a typical basic industry — MOTOR VEHICLES AND PARTS— (see chart at right). Of the 10921 standard knee type horizontal, vertical, bed and manufacturing type milling machines and precision boring machines in use today — *which could be replaced by Tool-Lease* equipment — 33% are 10-20 years old, 18% are more than 20 years old!



HERE'S THE OVERALL PICTURE IN THE ABOVE AND 15 OTHER BASIC INDUSTRIES

Of the 150,825 machine tools in these industries of the types covered by Tool-Lease — 18% are over 20 years old and 38% are from 10-20 years old. A break-down on any of these industries will be furnished upon specific request.

30%	26%	54%	Agricultural equipment
28%	35%	37%	Special industry machinery
21%	33%	44%	Const., mining and oil well equip.
22%	33%	45%	General industrial equipment
32%	32%	46%	Metalworking machinery
22%	27%	41%	Office and store machines
13%	39%	48%	Domestic and service equipment
19%	39%	42%	Electrical equipment
19%	37%	44%	Misc. machine parts and jobbing
18%	33%	49%	Motor vehicles and parts
4%	38%	58%	Complete aircraft
2%	51%	47%	Aircraft engines, propellers & parts
16%	54%	30%	Railroad equipment
18%	36%	46%	Fabricated metal products
14%	48%	38%	Shipbuilding, ordnance and misc.
11%	37%	52%	Precision mechanisms

Figures for this presentation adapted from 1953 McGraw-Hill survey of metalworking industry.

TOOL-LEASE — A COMMON-SENSE APPROACH TO PLANT MODERNIZATION

Kearney & Trecker's Tool-Lease Program offers operating management a way to stop the trend of rising costs, increasing competition and shrinking profit margins. With Tool-Lease, you can enjoy optimum flexibility to meet changing production requirements while avoiding the risk of high obsolescence. What's more, Tool-Lease provides a way to keep your plant modern without tying up working capital.

TOOL-LEASE OFFERS A CHOICE OF PLANS TO MEET INDIVIDUAL NEEDS

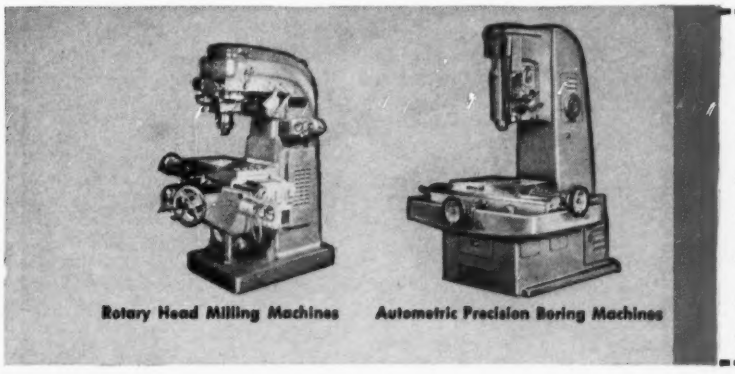
Under Tool-Lease, you can rent any of the standard Kearney & Trecker *knee or bed type milling machines or precision boring machines.* All are available under three basic plans, with varying options to continue or terminate the lease or to purchase the equipment. If you require special machinery or heavy-duty CSM bed types, special agreements will be considered.

GET ALL THE FACTS NOW

For complete information on Tool-Lease . . . help in analyzing your milling and/or precision boring needs — see your Kearney & Trecker representative or mail coupon to Kearney & Trecker Corp., 6784 W. National Avenue, Milwaukee 14, Wisconsin.

TOOL LEASE
KEARNEY & TRECKER
MILWAUKEE
MACHINE TOOLS
EQUIPMENT ®

©1954



Rotary Head Milling Machines — Automatic Precision Boring Machines

Kearney & Trecker Corporation
6784 W. National Ave.
Milwaukee 14, Wis.

Please send me Bulletin TL-10A with details on the Tool-Lease Program or call Milwaukee, GReenfield 6-8300.

Name.....

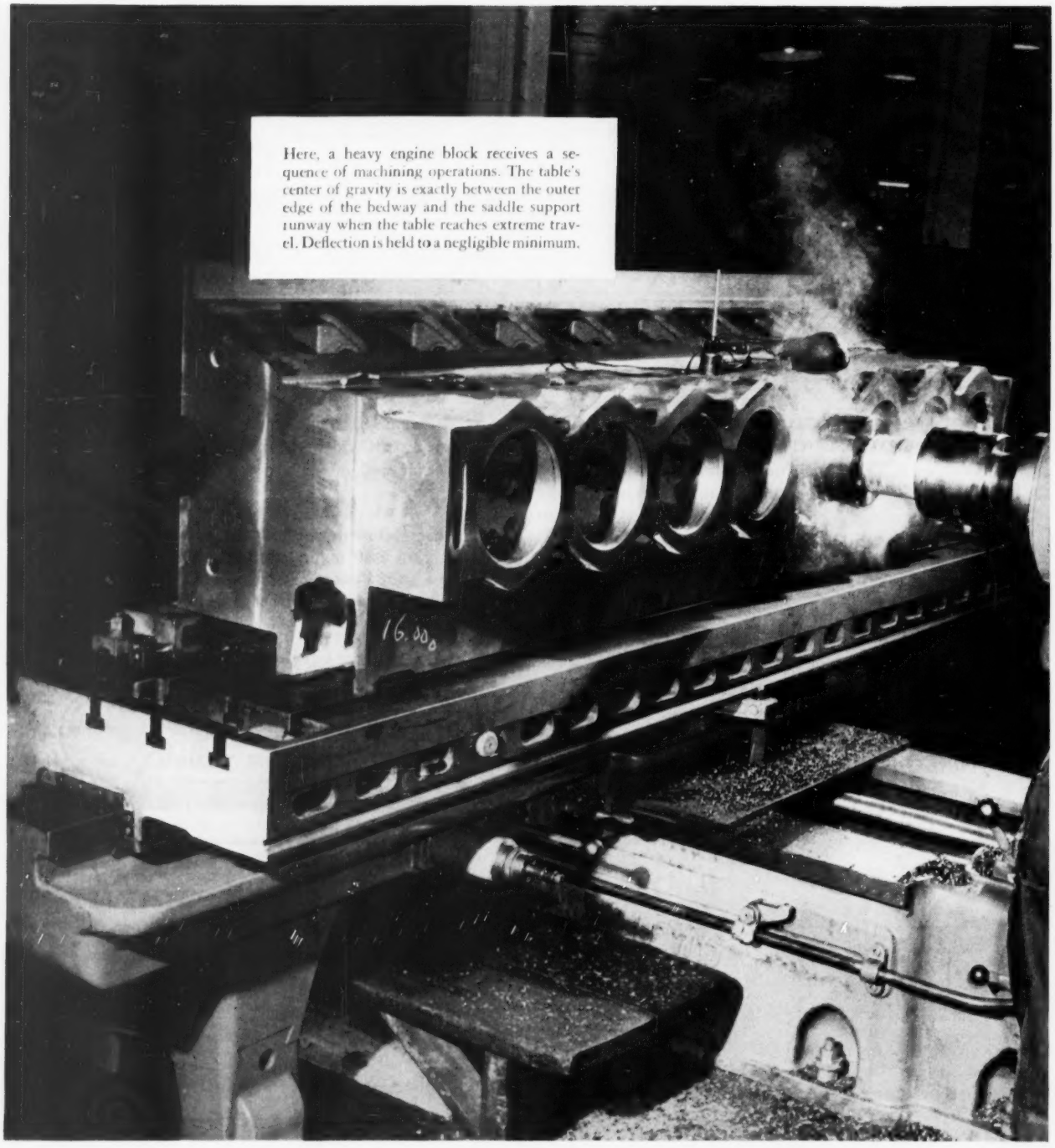
Title.....

Company.....

Address.....

City..... Zone..... State.....

G&L 30 Series offers over the widest working



Here, a heavy engine block receives a sequence of machining operations. The table's center of gravity is exactly between the outer edge of the bedway and the saddle support runway when the table reaches extreme travel. Deflection is held to a negligible minimum.

you greatest precision ranges...HERE'S PROOF

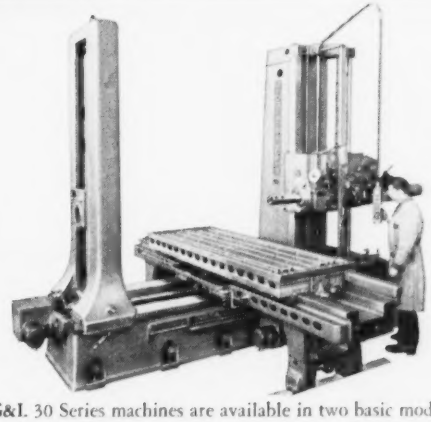
Extended saddle, saddle supports and auxiliary runways are available with G & L 30 Series Table Type Horizontal Boring, Drilling and Milling Machines. This exclusive method of supporting the table takes the risk out of precision-machining large workpieces requiring full range of the machine.

A *fully-supported*, extended saddle is absolutely vital when a long table and high columns are used to precision-machine a sequence of different surfaces on a heavy workpiece. The G&L design incorporates an extended saddle that minimizes deflection and is provided with full support even when the table is at its outermost travel limits.

What's more, G&L has engineered a system of concentric leveling (see lower right) which insures perfect alignment and parallelism between rails, saddle supports, saddle and table.

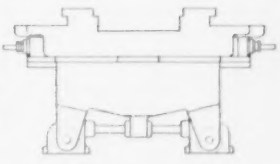
These are only a few of the many advantages you get with a modern G&L Horizontal. A selection of many other standard and optional features gives you the exact machine you need — a machine that's unsurpassed for accuracy, capacity, simplified operation and years of outstanding performance.

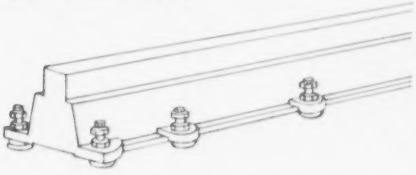
For complete details, see your G&L representative or write for catalog No. 30.



G&L 30 Series machines are available in two basic models — the 350-T (shown) with a 5" spindle and 25 hp, and the 340-T with a 4" spindle and 20 hp. Note how the under-the-floor runways allow the operator to perform his job without having to climb over the machine.

Adjustable brackets with hardened and precision-ground steel rollers. Located one to each support leg, they engage hardened and ground steel rails, are protected by spring-loaded wipers.





On runway, large diameter adjusting screws are threaded through flange and drilled to receive foundation bolts. Rails are sunk into foundation so tops are even with floor level. Rails and machine are separately leveled and saddle support brackets adjust independently.

Builders of the world's finest heavy-duty machine tools — Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; Hypro Double Housing and Openside Planers; Planer Type Milling Machines and Vertical Boring Mills; and Davis Cutting Tools.

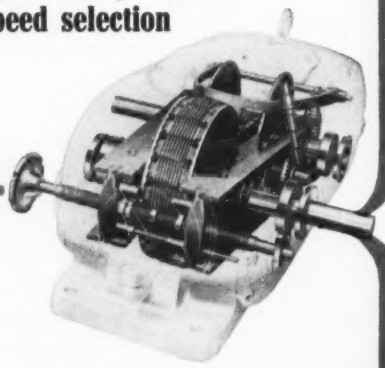
GIDDINGS & LEWIS MACHINE TOOL CO.

FOND DU LAC, WISCONSIN

WHY ALL industry uses P.I.V.

LINK-BELT's P.I.V. provides positive, infinitely variable speed selection

ALWAYS POSITIVE



ALWAYS STEPLESS

WHEREVER speeds must be varied—instantly, exactly, positively—you'll find Link-Belt's P.I.V. at work. Here's a variable speed drive that operates independent of friction. Exclusive self-tooth-forming chain meshes with grooved wheels, transmits power with no wasteful slip.

Without stopping the machine, you can select the speed you need—from maximum to minimum settings. And at any speed, full-rated horsepower is delivered.

If there's a process in your plant that requires precise speed selection, get all the facts about compact, all-metal P.I.V. Write for Catalog 2274, or call your nearest Link-Belt office or distributor. 13.431

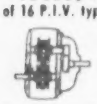
LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices, Stock Carrying Factory Branch Stores and Distributors in All Principal Cities. Export Office: New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

LINK-BELT

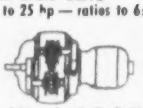
P. I. V. VARIABLE SPEED DRIVE

4 of 16 P.I.V. types, ½ to 25 hp — ratios to 6:1

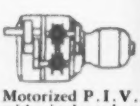
Basic P.I.V. Like all others, it is built for horizontal or vertical mounting.



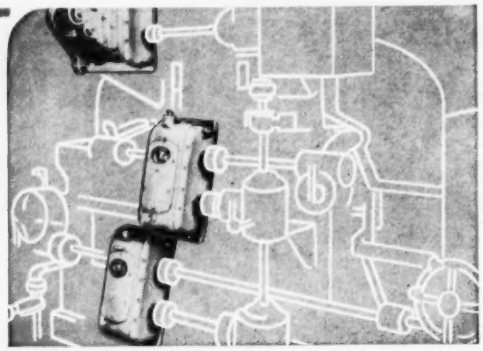
P.I.V. with single reduction input or output helical gears.



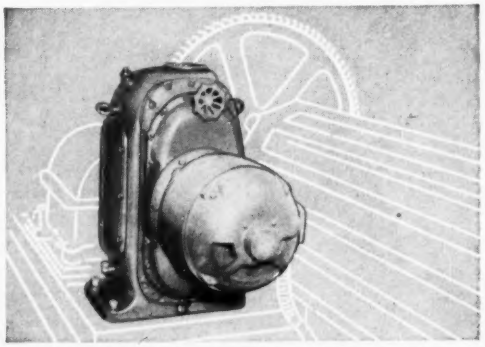
Motorized P.I.V. with single reduction input and output helical gears.



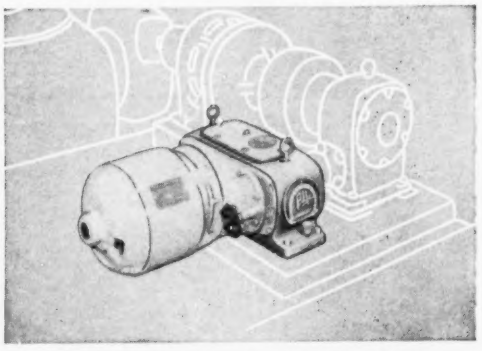
Motorized P.I.V. with single reduction input and double reduction output helical gears.



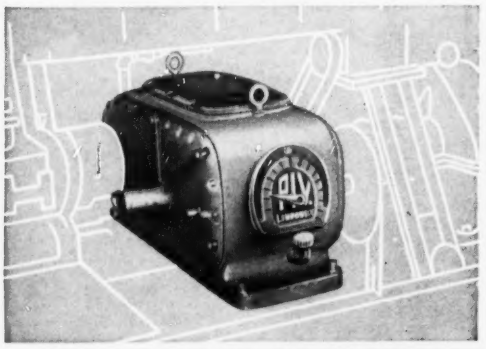
POSITIVE OPERATION OF DIFFERENTIAL SPEED EQUIPMENT. P.I.V. also provides precise regulation of rotary motion.



FLEXIBILITY IN TIMING. In addition, P.I.V. offers accurate control of processing speeds, unaffected by atmospheric conditions.



STEPLESS CONTROL OF PRODUCTION LINES OR INDIVIDUAL MACHINES, either manually or automatically, positively, dependably.



EXACT SYNCHRONIZATION OF ROTATING PARTS AND MACHINES. P.I.V. is needed where automatic sequence control must be stepless.

For more information on products advertised, use Inquiry Card, page 265

GARDNER

precision disc Grinders

Tree Ends Of Turbine Buckets Finished On Double Spindle Grinder

TWO parallel surfaces ground in **ONE** operation

WORK DATA

MACHINE—Gardner 125-26" Double Spindle Grinder with rotary work carrying fixture.

OPERATION—Grinding tree ends of jet turbine buckets.

STOCK REMOVAL—Up to 3/16" maximum stock per surface.

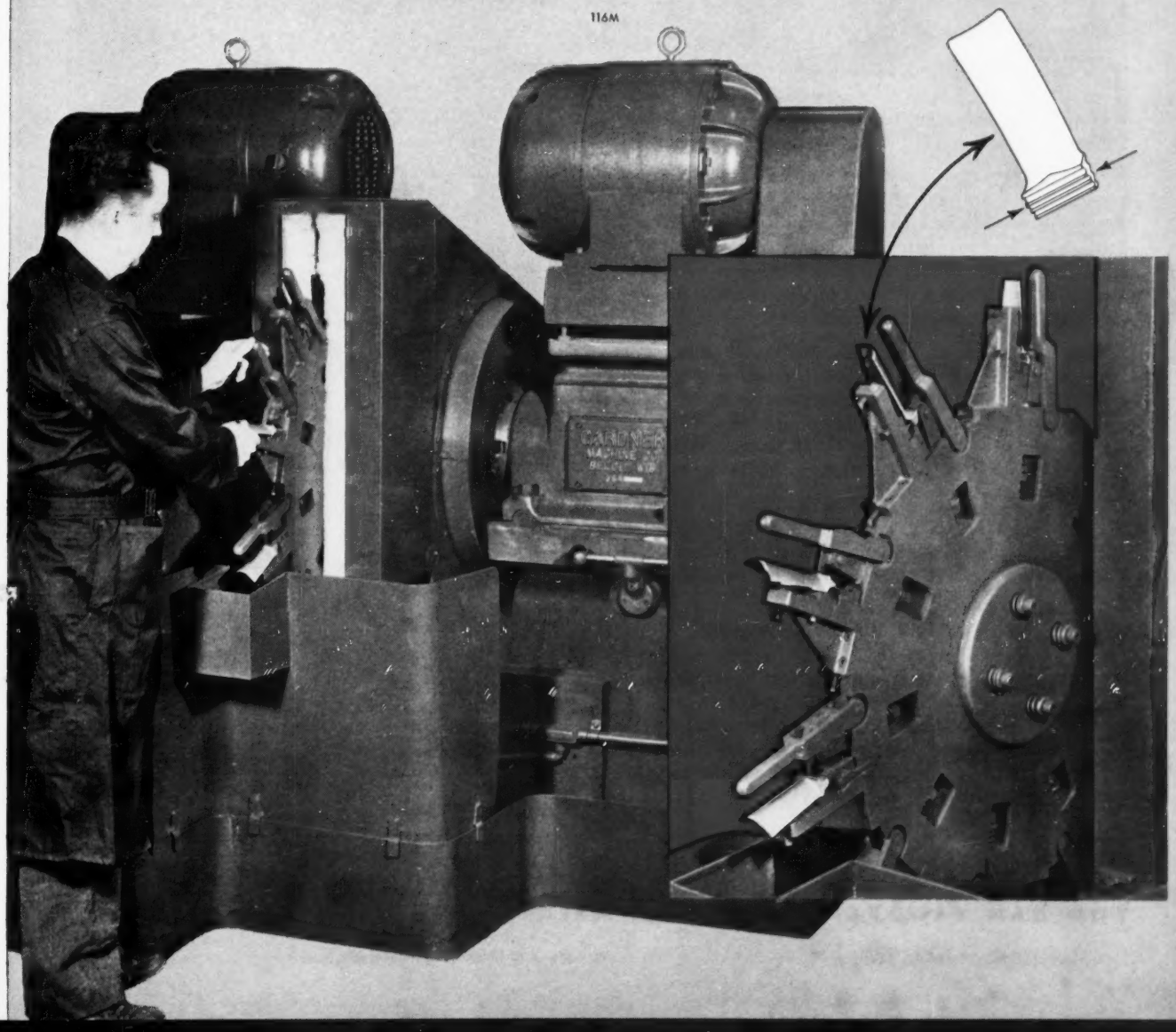
TOLERANCE—.003" for uniformity and .0005" for squareness.

PRODUCTION—90 to 100 per hour, complete, in two cuts.

For help with your flat surfacing problems, send us your blueprints for production estimates and tooling suggestions.

GARDNER MACHINE COMPANY
414 Gardner St., Beloit, Wisconsin, U.S.A.

116M



Story of a Reliefer that became the No. 1 Starter

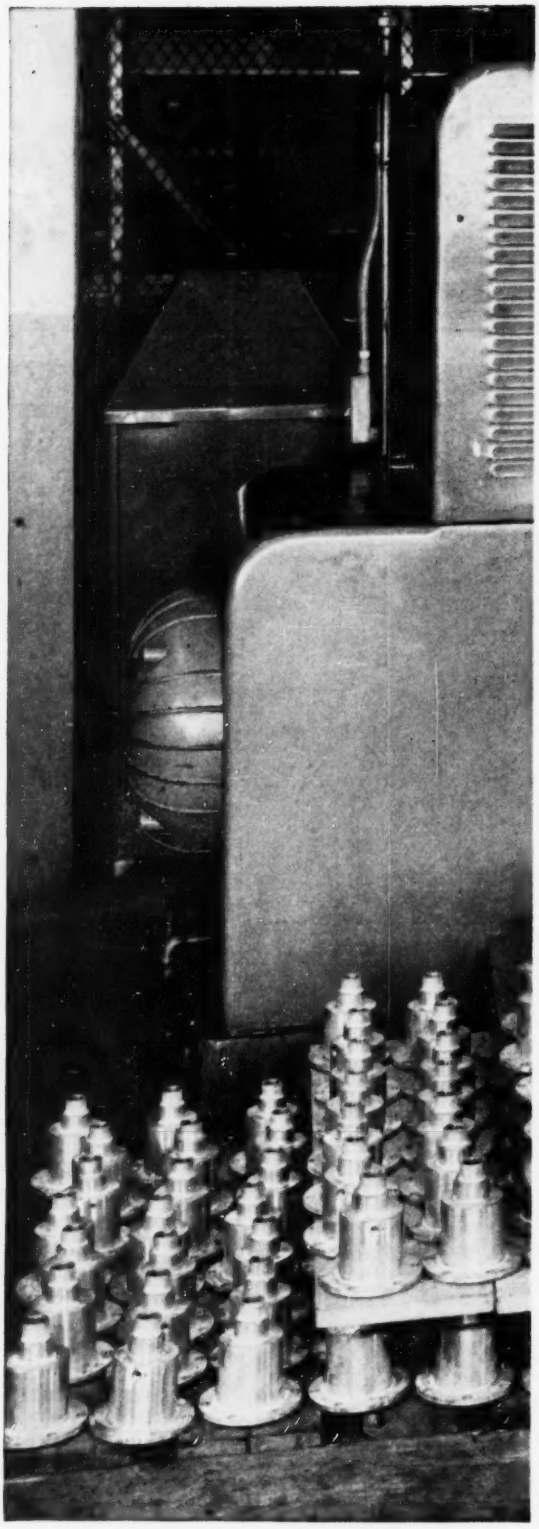
IT CAN HAPPEN with machines as well as men. Ask the Powers Regulator Company of Skokie, Illinois—manufacturer of automatic temperature and humidity control systems.

Powers Regulator, like many companies, was faced with the necessity of increasing production of a battery of turret lathes, some of which needed replacement. They also wanted to call in some of their subcontracted work. So they bought a Warner & Swasey 1 AC Single Spindle Automatic to help take the pressure off their hand-operated machines.

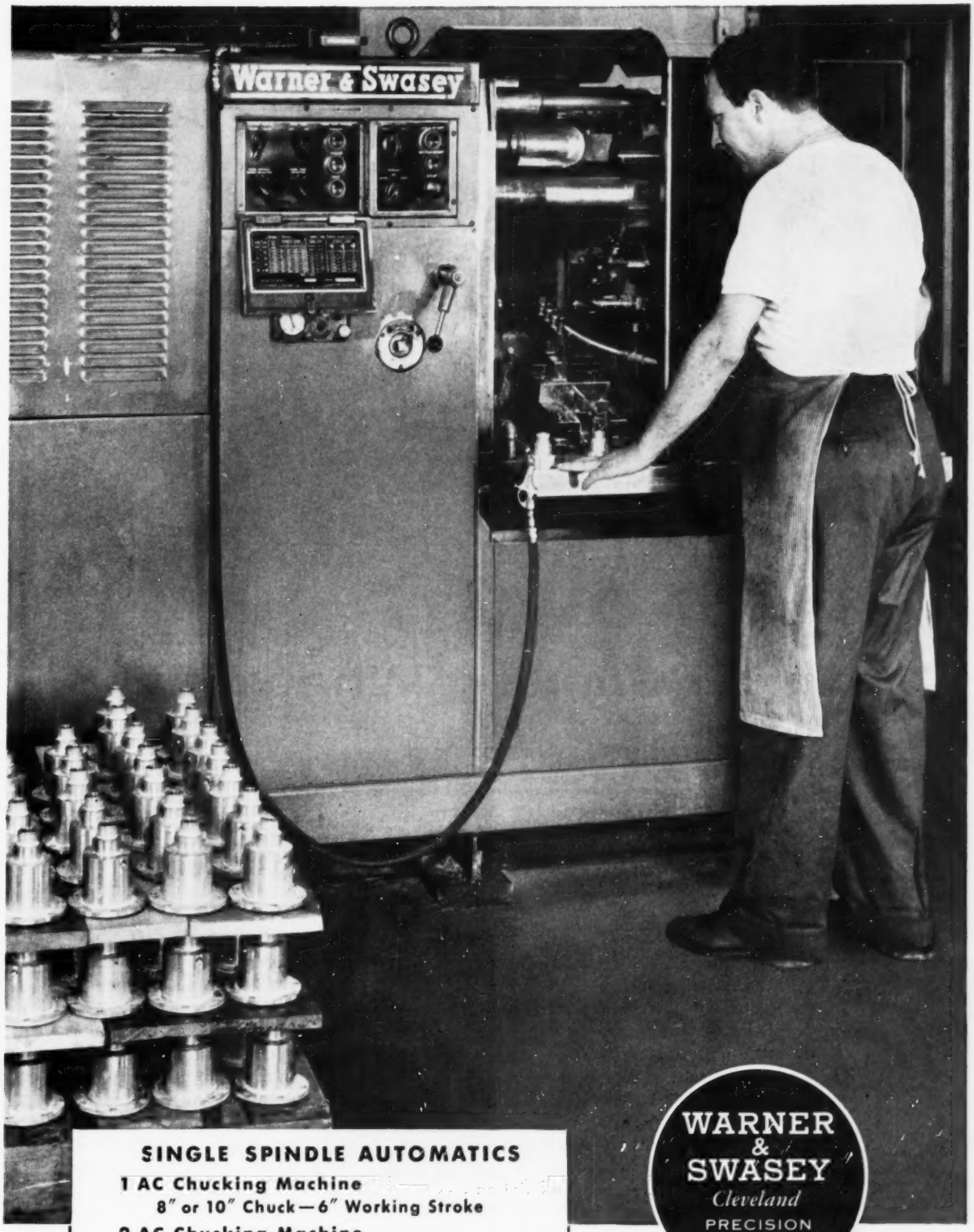
This company soon discovered that they had never fully realized the tremendous work potential of the 1 AC. It kept taking over more and more turret lathe work—increasing the production on some of the more complex pieces as much as three times. So the company scheduled the 1 AC for additional shifts—still more work.

The machine really did the job cut out for it! It eased the load on the turret lathes, and the company recovered work previously subcontracted. It performed so well, in fact, that Powers Regulator has since added a second 1 AC.

This story is not unusual. The 1 AC's quick setup and extreme accuracy make it ideal for increasing production on many turret lathe jobs—while requiring less skilled operators. And its advantages as an automatic cuts costs on short and long run jobs. But find out how the 1 AC will boost profits in your plant—call in our nearest Field Engineer for all the facts.



YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS WITH WARNER &



SINGLE SPINDLE AUTOMATICS

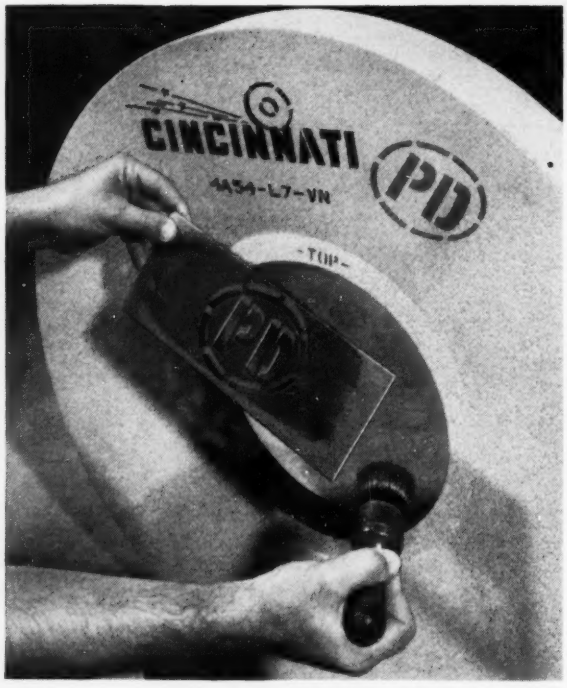
1 AC Chucking Machine
8″ or 10″ Chuck—6″ Working Stroke

2 AC Chucking Machine
10″ or 12″ Chuck—9″ Working Stroke

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

SWASEY MACHINE TOOLS, TEXTILE MACHINERY, CONSTRUCTION MACHINERY

For more information on products advertised, use Inquiry Card, page 265



NOW!

Cincinnati Grinding Wheels offer

PD POSITIVE DUPLICATION

The CINCINNATI (PD) Manufacturing Process is the greatest grinding wheel development in years—an achievement in precision manufacturing and quality control that means a brighter working picture for you.

Through the CINCINNATI (PD) Manufacturing Process, you can be *positive* that *every* CINCINNATI (PD) Wheel you order will be produced exactly to the Cincinnati grading specified for your job.

And, just as a negative guarantees exact duplication of a photograph, the CINCINNATI (PD) Manufacturing Process assures a POSITIVE DUPLICATION of the original wheel EVERY time you reorder.

The problem of duplication has been a major concern of Cincinnati Milling throughout its 30 years of practical experience in using grinding wheels, and in supplying industry with precision grinding machines equipped with grinding wheels and ready for production operation. Cincinnati Milling found that once the right grinding wheel had been specified for a particular job, sometimes it was difficult to secure additional wheels of identical grading that would duplicate the performance of the original wheel. The need for positive duplication in the manufacture of grinding wheels is of utmost importance not only to Cincinnati Milling, but to every user of grinding wheels.

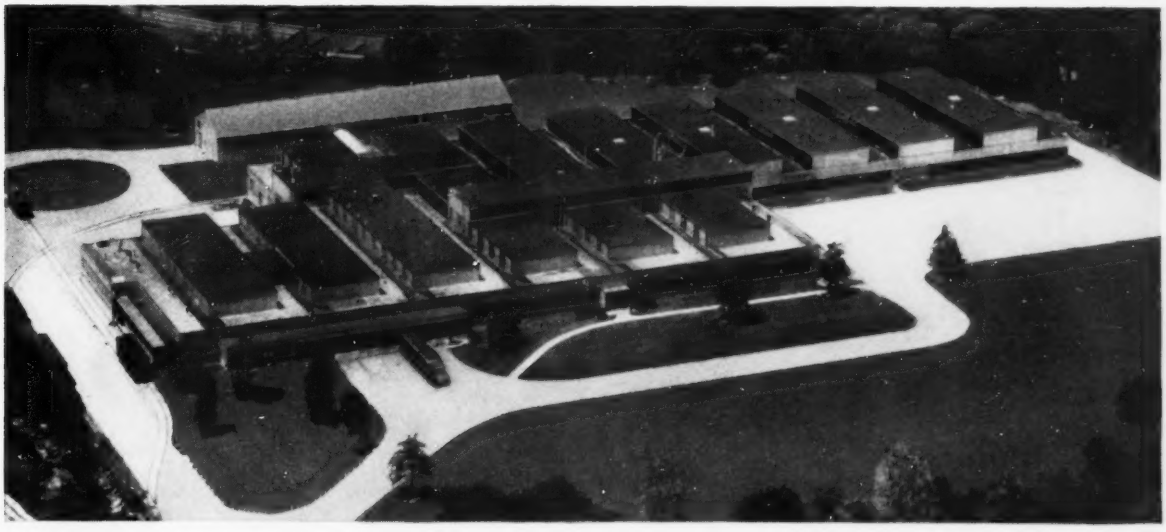
Positive Duplication (PD) is the result of extensive manufacturing research which revealed that *several steps* in the production of grinding wheels generally considered as unimportant, were quite to the contrary, *extremely important.* As one step toward (PD) Wheels, Cincinnati Milling constructed the world's most modern, most completely equipped grinding wheel plant. Some of the equipment installed has never before been used by the industry in the manufacture of grinding wheels.

Then, to make (PD) Wheels an actuality, Cincinnati Milling developed new standards of manufacture with 36 quality control steps. From the weighing of the grain and bonding material, through molding, drying, firing, finishing, to final inspection, every operation is

carried out with the same exactness as in building a precision machine tool.

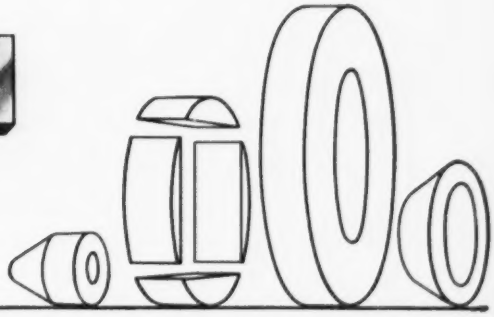
You're assured a POSITIVE DUPLICATION of the original wheel EVERY time you reorder. "On grade" with a CINCINNATI (PD) Wheel means all future (PD) wheels will act and grind exactly alike. For you, this means *no more* production interruptions which cut output and increase your costs.

Let us prove to you how CINCINNATI (PD) Wheels will make money for you. Just contact us and we'll send one of our representatives—men who know grinding and grinding machines as well as grinding wheels. Write, wire or 'phone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.



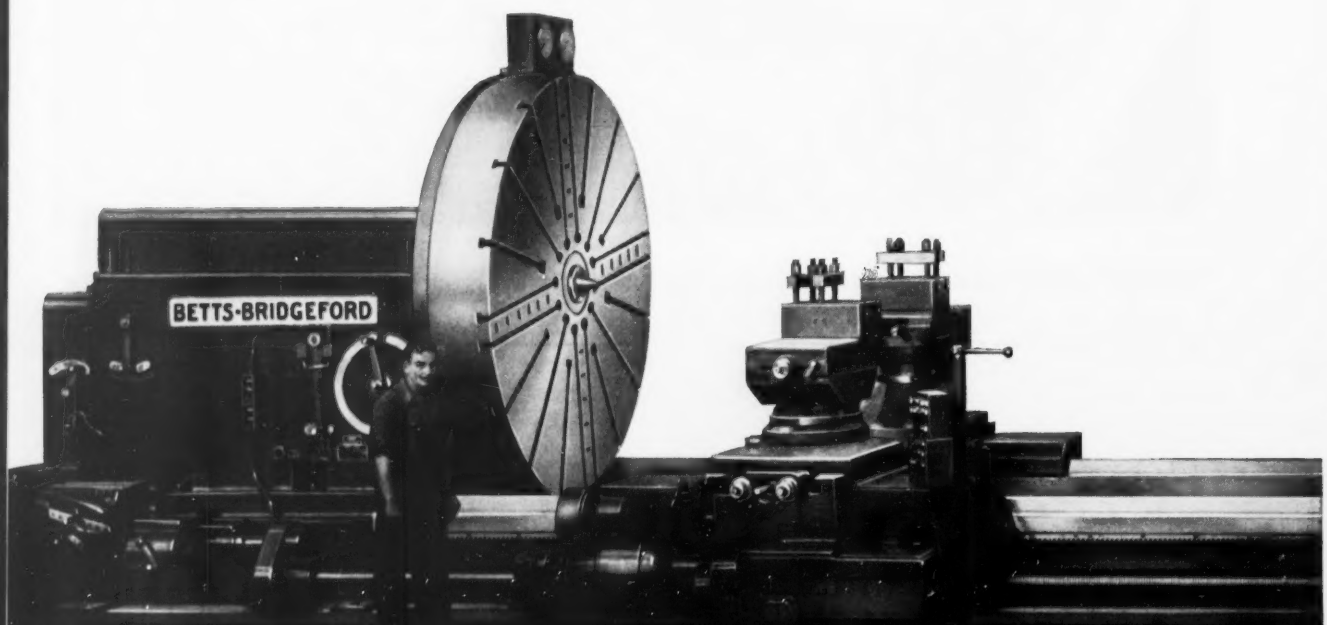
The CINCINNATI (PD) Manufacturing Process was made possible by this plant--the world's most modern, most completely equipped grinding wheel plant.

CINCINNATI
Grinding Wheels
THE CINCINNATI MILLING MACHINE CO.
Cincinnati 9, Ohio



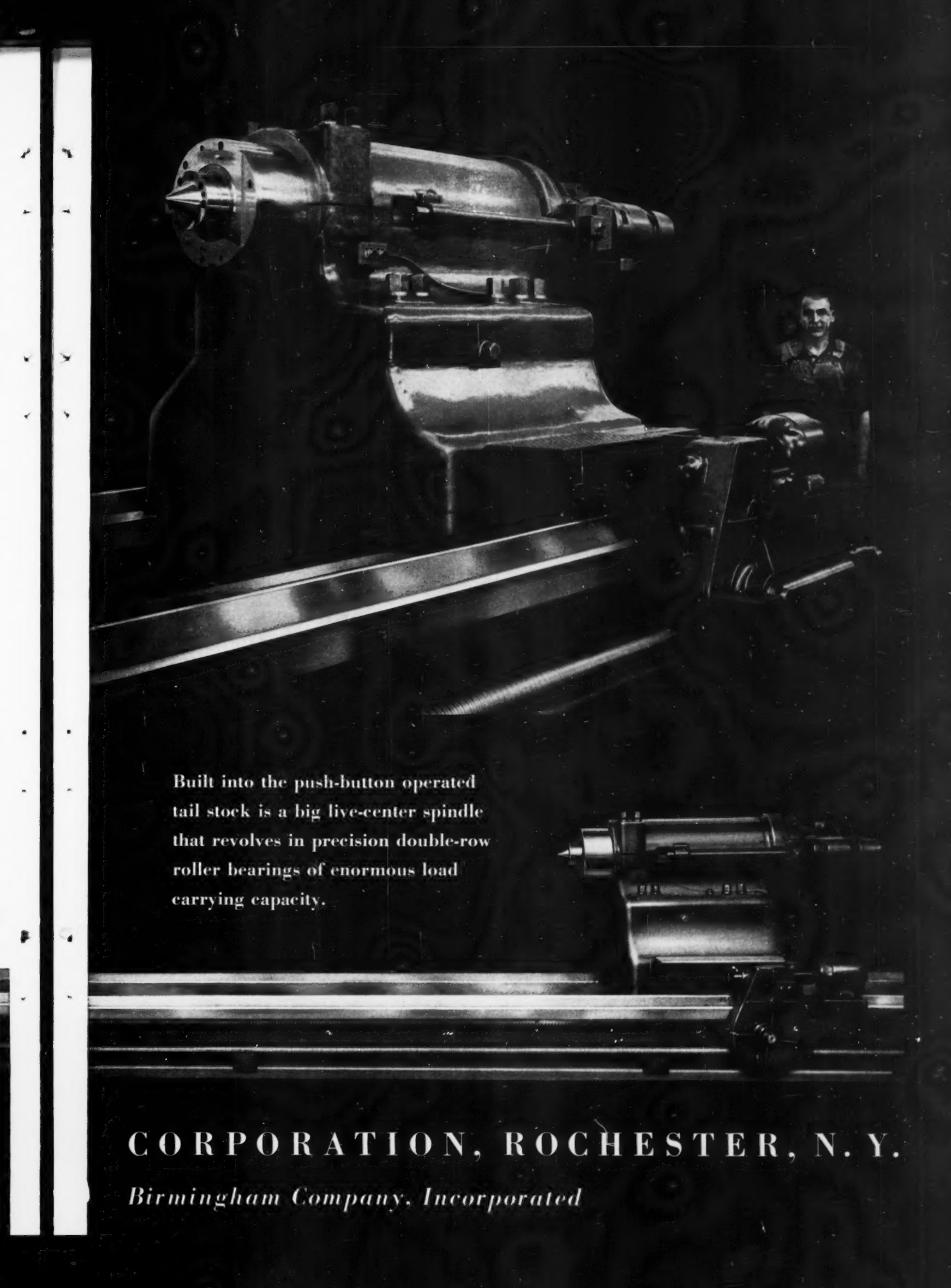
Another Big One!

A 96 Inch Heavy-Duty Betts-Bridgeford Lathe for the precision turning of forged steel steam turbine shafts weighing up to 90 tons!



CONSOLIDATED MACHINE TOOL

Wholly owned subsidiary of Farrel-



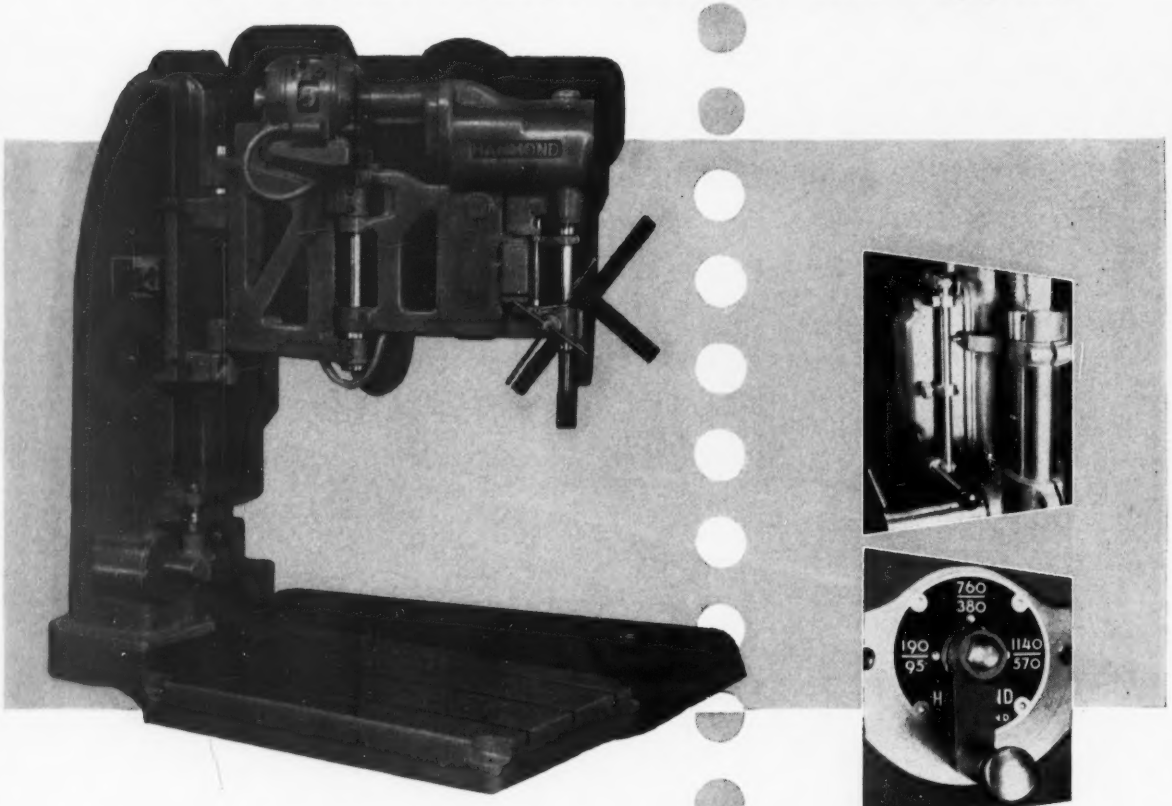
Built into the push-button operated tail stock is a big live-center spindle that revolves in precision double-row roller bearings of enormous load carrying capacity.

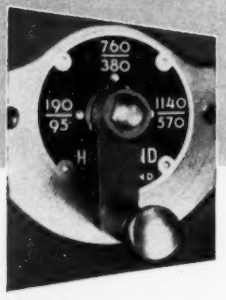
CORPORATION, ROCHESTER, N. Y.

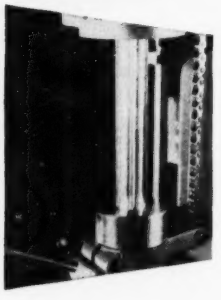
Birmingham Company, Incorporated

FOOTBURT

for faster radial drilling and tapping







Hammond Radial Drilling and Tapping Machines may be spotted in the production line for drilling, tapping or reaming. With its unique Bracket Type construction the spindle can be swung quickly from hole to hole. Six Quick Speed Changes are instantly available and the Hammond Tapping Reverse is very fast and convenient to operate.

THE FOOTE-BURT COMPANY

Cleveland 8, Ohio

Detroit Office: General Motors Building

engineered for production

FOOTBURT

MACHINE TOOLS

For more information on products advertised, use Inquiry Card, page 265

No BUTTS about it...

CIMCOOL with "95-59" eliminates rancidity and foul odors

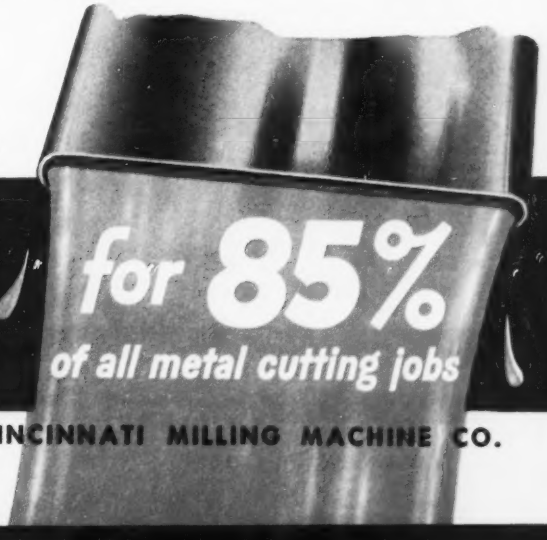
If the odor in your plant these days is "getting your goat"—then you'll want to know about this important discovery:

Actual scientific laboratory and shop tests prove—beyond any doubt—that CIMCOOL° with "95-59" eliminates rancidity and foul odors . . . and is positively non-irritating to the skin!

Plant after plant reports that this radically new and different coolant—this *chemical emulsion*—is the biggest working improvement in years. The amazing ingredient "95-59" is a more effective bactericide, is non-corrosive, and eliminates rancidity and foul odors—*even in the hottest weather.* That's why CIMCOOL, in contrast with old-fashioned cutting fluids, can be kept at work longer. Thus, CIMCOOL greatly reduces down-time and labor costs for cleaning and changing.

Let us prove that there are no ifs, ands, *or* buts about CIMCOOL'S superiority. For a demonstration in your own machines, just write, wire or telephone Sales Manager, Cincinnati Milling Products Division, The Cincinnati Milling Machine Co., Cincinnati 9, Ohio.

° Trade Mark Reg. U.S. Pat. Off.



CIMCOOL

for 85% of all metal cutting jobs

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

ARMSTRONG WRENCHES

Choose Your Wrenches as you do your friends--for life

Specify ARMSTRONG Wrenches for lifetime service, for finely balanced tools that feel right in the hand and make work easier, faster and less fatiguing. ARMSTRONG Wrenches generally are longer for size—give greater leverage. Accurately milled or broached openings give the proper clearance. They are safe wrenches because they are strong beyond need.

Drop forged and machined from high tensile carbon or special alloy tool steels, ARMSTRONG Wrenches are heat treated, tempered and tested to an exact balance of toughness, hardness and tensile strength. Each is beautiful in finish and line, is a quality tool to be proudly possessed by any mechanic—or certain to "give a lift" to any assembly line. Buy wrenches which carry the trade marks HI-TEN or ARMALOY. On carbon or alloy steel wrenches these trade marks are your guarantee of lifetime quality.

WRITE FOR CATALOG

ARMSTRONG BROS. TOOL CO. *"The Tool Holder People"* 5213 W. ARMSTRONG AVENUE CHICAGO 30, ILL.

For more information on products advertised, use Inquiry Card, page 265

Production Pointers from GISHOLT

GISHOLT TIME-SAVING IDEAS

Presented as a service to production men, we hope some of these interesting ideas, chosen from thousands of jobs, will suggest ways to help you cut time and costs in your own work.

FINISHING LARGE AND SMALL DIAMETERS AT THE SAME TIME

Speeder-Operated Boring Bar Does the Trick

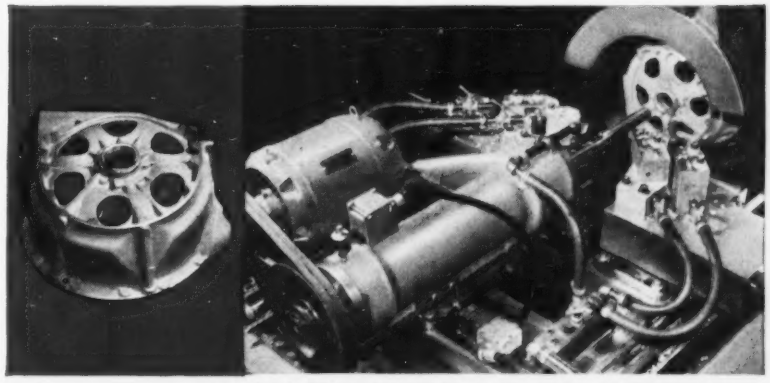
How to achieve both high speed and fine finish on these die-cast aluminum torque converter housings? Here's a nice example of production planning that does it!

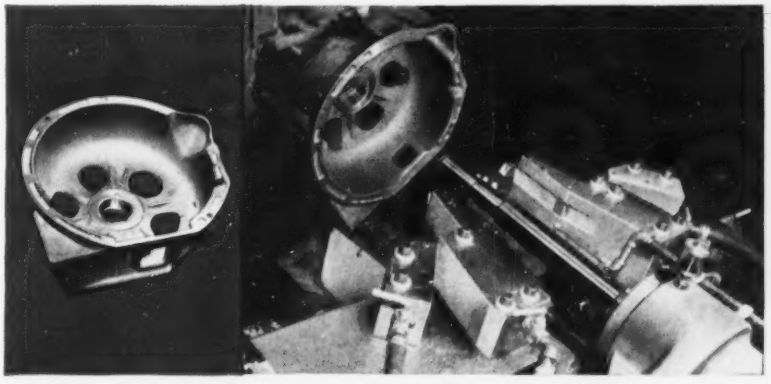
This fast, two-operation job is done on a pair of Simplimatic Automatic Lathes. For the first side, the workpiece is clamped on the large flange face by means of an air-operated drawback fixture with location and drive from dowel holes in the flange. Tools mounted on the front and rear slides rough and finish face.

While the front and rear slides are working, tools on a special speeder-equipped, piloted boring bar mounted on the center slide bore and chamfer. Spindle speed is 500 r.p.m., and with the speeder operating, boring speed is increased to 800 r.p.m.—just the right combination of speeds for uniform finish on the machined surfaces. Time for this operation is under 1 minute f.t.f.

Same Operator Runs 2nd Machine

For the final operation, a special air-operated drawback fixture is also used, locating and driving from dowel holes in the large flange. Part is held against large flange face by clamping through three cored holes. There is a vibration dampener between the fixture and large flange face for quieter operation and prevention of possible chatter.





First Machine with special speeder-operated boring bar.
Second Machine also has special boring bar speeder arrangement.

Once again tools on the front and rear slides rough and finish face while tools on the special, speeder-equipped, piloted boring bar counterbore and chamfer. Again, time is less than 1 minute, f.t.f. One operator can easily handle both machines with hourly production totaling 48 completed housings at 80% efficiency.

Rotating the boring bar as well as the work provides correct speeds for machining all surfaces while saving time and achieving fine finish.

There's a great deal of interesting information in the pages of the Simplimatic catalog; also many helpful job reports. Write for your copy.

GISHOLT

TIME-SAVING IDEAS

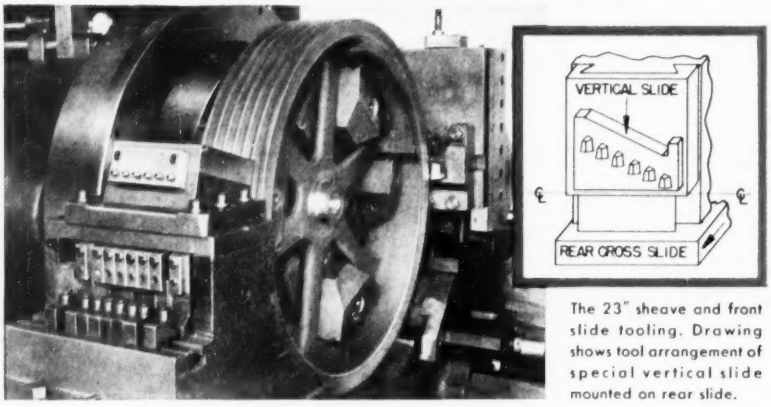
GOOD TIPS ON MACHINING SHEAVES

Novel Tooling on Fastermatic *Automatic* Turret Lathe

Everybody's looking for new ways to get speed and quality at lower cost! Aren't you? Here's a fine example of how you can do it in machining large sheaves.

The 23" diameter parts are handled on a Fastermatic Automatic Turret Lathe. All work on the hub is performed with standard tools on the hexagon turret—drilling, boring, reaming, facing and turning. Tools on a special back-facing attachment, operated through the spindle, face and turn the opposite end.

Of special interest is the unique method of machining the six grooves. First, tools on a special tool block mounted on the front slide rough out the grooves and chamfer the edges. Then, via a smart skiving operation, the grooves are finish-formed. This is done by six tools carried in a special vertical slide mounted on the rear slide. After the rear slide feeds in to a dead stop and holds up, the vertical slide feeds downward. Each tool is mounted slightly higher than the tool preceding it. One tool at a time cuts its groove as it feeds past the center line—assuring fine, smooth finishes with no distortion trouble.



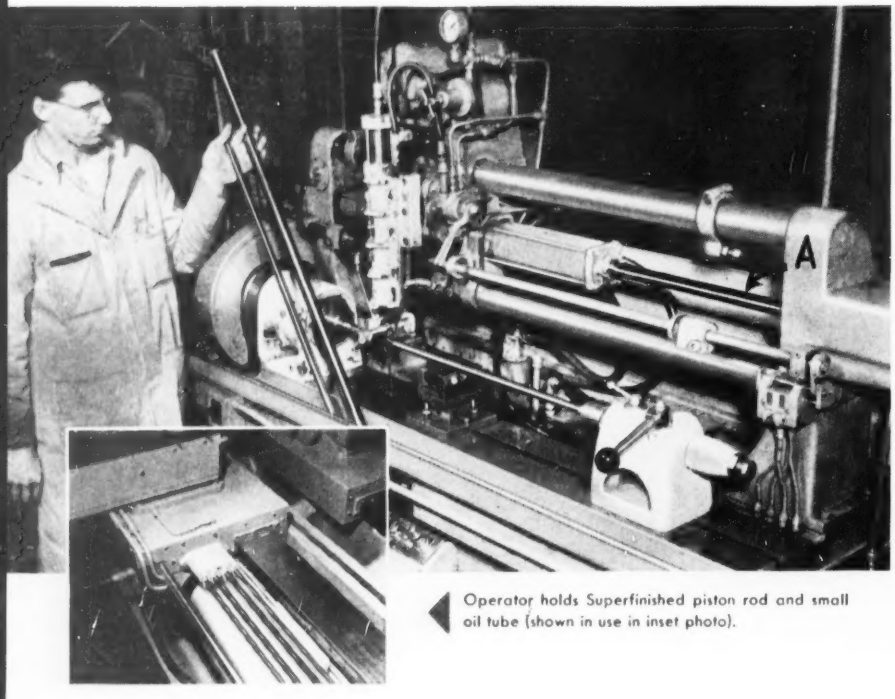
The 23" sheave and front slide tooling. Drawing shows tool arrangement of special vertical slide mounted on rear slide.

This novel single-tool method of finish-forming the grooves eliminates distortion to assure better finish. Automatic production cuts costs.

* * *

PUTTING AN END TO OIL SEAL PROBLEMS

Low-Cost Superfinish Means Better Operation—Less Maintenance



Operator holds Superfinished piston rod and small oil tube (shown in use in inset photo).

In more and more cases, Superfinishing is becoming a part of original specifications. Here it was specified to prevent oil seal troubles and provide more satisfactory and lasting service.

The smaller tube held by the operator is a telescoping connection carrying high-pressure oil to carriages and slides on Gisholt No. 24 Hydraulic Automatic Lathes. For a positive oil seal, the full length is Superfinished to 2½ to 3½ micro-inches from a ground surface of 20 to 30 micro-inches. The same is true of the large rod which is a hydraulic cylinder piston rod similar to "A" on this Superfinishing machine.

Superfinish removes all smear metal left from previous grinding operations. It also eliminates chatter marks and grinding flats which normally cause excessive packing wear and frequent servicing.

Low micro-inch surface readings are quickly obtained at little cost with this Superfinisher which does the job in a fast, automatic cycle.

GISHOLT

TIME-SAVING IDEAS

THEY WASTE NO TIME HERE...IN PRODUCTION OR CHANGEOVER

117 Parts per Hour with No. 12 Hydraulic Automatic Lathe

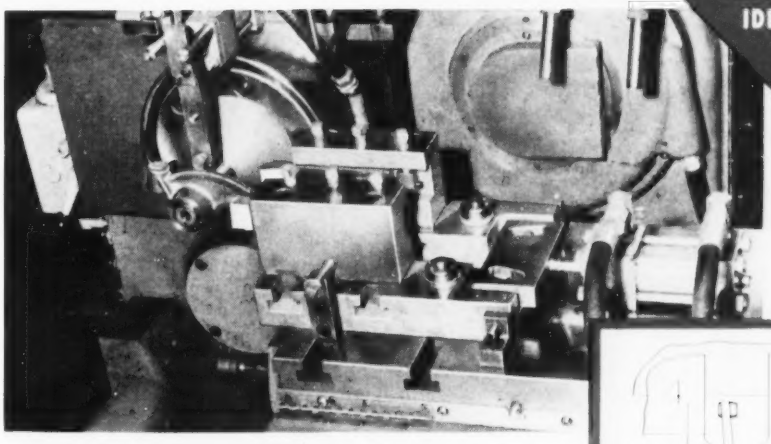
A simple enough machining job, this one. But it shows what can be gained by careful start-to-finish planning.

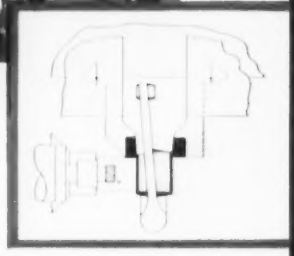
The problem is twofold—speedy straddle facing for these parts, and at the same time—fast, easy changeover for 13 different sizes.

The machine is a Gisholt No. 12 Hydraulic Automatic Lathe—a machine you can't beat for work of this kind. In this case, all work is done from the rear slide, leaving the front of the machine clear for extra-fast loading and unloading.

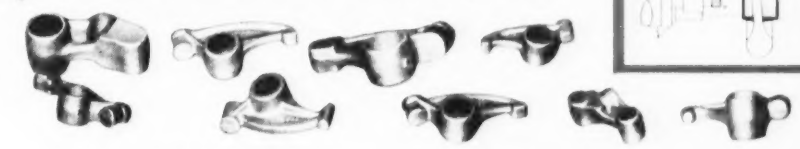
The workpiece is slipped on an air-operated expanding mandrel, locating from the face of the rocker web against an adjustable jack at the base of the air-operated retractable locator.

To start the cycle, the operator raises a single lever which chucks the part on the mandrel and retracts the locator which in turn actuates a limit switch starting the machine. The rear independent slide feeds forward with tools straddle-facing both hubs. There is tool relief at the end of the cut. Fast starts and stops are provided by the electric clutch and brake. Production is at a rate of 117 parts hourly at 80% efficiency.





Below, typical parts handled by No. 12 Hydraulic Automatic Lathe. Note that tool blocks pivot at end of cut, providing tool relief.



As for swift, simple changeover, here's all there is to it: an easy sideward adjustment of tool blocks is made in T-slotted bases; the locator jack is altered and the mandrel is changed for size.

Nearly 2 parts a minute are produced here because of fast loading, starting and machining provided by the No. 12 Automatic Lathe.

Twenty-eight interesting examples of quality production of both simple and complex parts are pictured in the complete new No. 12 catalog. Write for it.

★ ★ ★

CAN THIS KIND OF BALANCING HELP YOU?

Workpiece is handled in overhanging position

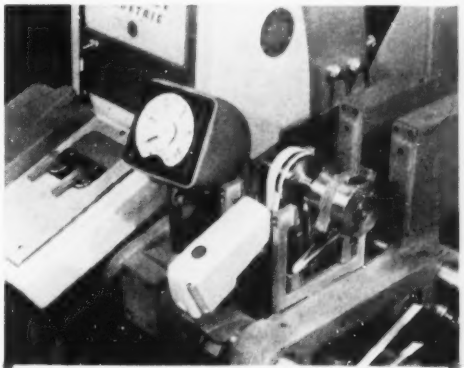
High-speed shaper heads used in woodworking must be accurately balanced. This eliminates vibration during operation, preventing "ripple" or "chatter" marks from marring molding surfaces.

This manufacturer of woodworking equipment solved his problem by dynamically balancing all shaper heads. To simplify and speed up the balancing operation, the Gisholt Improved Type S Balancer is used. With this machine, the workpiece can be balanced in an *overhanging* position—to make loading easier and faster. Correction is made by drilling radially to the indicated depth in the left and right correction planes.

Production balancing to fine tolerances is "everyday work" for Gisholt Balancers. Both large and extremely small amounts of unbalance can be accurately measured and located because amplification is infinitely variable. Bearing movements as little as .000025" are accurately indicated on the standard machine.

Two-plane balancing of these high-speed parts is made faster, easier by use of overhanging arbor.

DYNETRIC BALANCERS GISHOLT



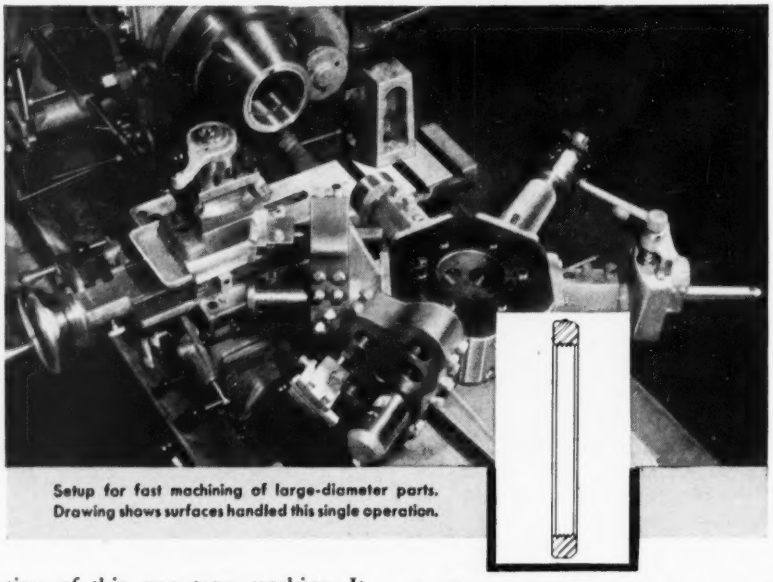
MODERN PRODUCTION BALANCING is one of many important subjects taught in the Gisholt Balancing School. Write for details.

GISHOLT

RAM TYPE TURRET LATHE DOES KING-SIZE WORK

TIME-SAVING IDEAS

Gisholt No. 5 Has Extra-Large Spindle Bore for Light Bar Stock, Tubing, Plastics



Setup for fast machining of large-diameter parts. Drawing shows surfaces handled this single operation.

It isn't often that ram type jobs call for a 4½" spindle bore. When sizes do get in this neighborhood, you may be able to cut costs even before the job is started. How? By proper selection of the machine.

This job illustrates the point. The large fuse liner nuts (and similar parts) are made from 4½" diameter seamless steel tubing. A Gisholt No. 5 Ram Type Turret Lathe was selected because it was available as a standard machine with a 4½" capacity spindle bore.

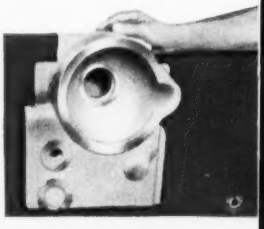
Machining the fuse liner nuts consists of facing, rough and finish boring and turning, chamfering, threading the I. D. and cutting off. Floor to floor time is 2.3 minutes.

The customer is really taking advantage of the faster, easier operation of this ram type machine. It has a hydraulic collet chuck and bar feed and a turret threading attachment. Even so, the cost is considerably below that of the larger type machine which usually handles this size work.

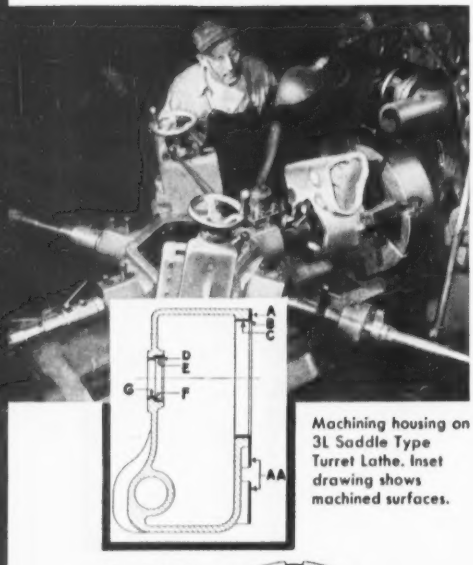
The first and most important step in cost saving here was in selecting the right machine for the job...the standard No. 5 Ram Type Turret Lathe with 4½" spindle bore. From then on low costs were easy.

★ ★ ★

REPETITIVE ACCURACY MADE CERTAIN THIS WAY



Dial Indicator on Saddle Type Turret Lathe Gives Visual Check



Machining housing on 3L Saddle Type Turret Lathe. Inset drawing shows machined surfaces.

What's the best way to maintain close tolerances in machining these awkward cast iron housings? This struck us as a pretty good answer.

Using a Gisholt 3L Saddle Type Turret Lathe, the large irregular-shaped workpiece is held in a 4-jaw independent chuck. Three diameters —*C*, *E* and *G*—are step bored and *D* is chamfered by tools mounted on piloted boring bars. The distance between face *A* and the base of cobore *F* is closely maintained, and a visual check of machine accuracy is provided by the dial indicator mounted on the finish boring bar. Line boring assures concentricity and permits holding close tolerances, part after part.

While boring takes place, tools on the square turret are used to face the front plate surface *A*, three bosses, *AA*, and chamfer *B*. Simultaneous use of tools on the hexagon turret and square turret shows there's time being saved... an easy matter with the full-swing side carriage and cross-slide features of the Gisholt Saddle Type Lathe.

Good chucking, good tooling with special attention to accuracy aided by a dial indicator assures a good rate of production with uniformity.

No. 7-854

627

THE GISHOLT ROUND TABLE represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

GISHOLT MACHINE COMPANY Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

NEW Ettco-Emrick
TAPPING ATTACHMENTS

THEY RUN IN OIL!

1. All the parts, including the clutch, run in a pumped oil bath which is sealed in at the factory . . . resulting in smooth, trouble-free service.

2. Feature for feature, there are no finer tapping attachments made . . . at any price!

NOW—FASTER TAPPING

For speed, you just can't beat these new tappers. They combine every feature needed to operate at topmost production speeds including a patented cooling system . . . hairline balanced construction . . . and a new supersensitive friction clutch.

SEE YOUR DISTRIBUTOR

OR

WRITE FOR BULLETIN 22A
for full details on sizes, capacities and prices.

ETTCO TOOL CO., INC.
592 Johnson Ave., Brooklyn 37, N. Y.

SEE YOUR LOCAL
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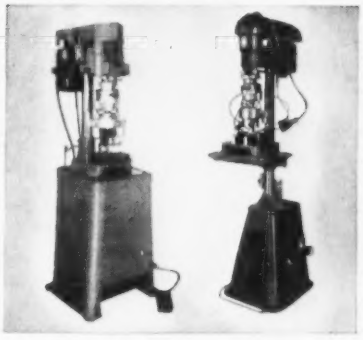
DISTRIBUTOR
He's been carefully selected for his technical know-how, his integrity and financial soundness. As a local businessman who depends on your support, he has a personal interest in providing a satisfactory answer to your problems and in giving you fast, efficient service.

DRILLING and TAPPING EQUIPMENT NEWS

Tapping Machines Boost Multiple Head Output



Ettco-Emrick tapping machines are designed for automatic or semi-automatic operation with multiple spindle drilling or tapping heads and single spindle tapping attachments. The No. 72A machine is foot or air-operated. The No. 74 machine is air operated and electrically controlled. *Details in Bulletins No. 72A and No. 74. Write Ettco Tool Co., 592 Johnson Avenue, Brooklyn 37, N. Y.*

Electric Indexing Fixture Has Fast, Precise Action

Ettco-Emrick Indexing Fixtures provide smooth, shockless, positive action. Can be used on any machine base. Synchronization of index fixture with outside machine member is electrically controlled. Utilizes interchangeable nesting plates ranging from 10" to 14" in diameter. *Details in Bulletin No. 97. Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn 37, N. Y.*

Balanced Tap Chuck Insures Greater Accuracy

Balanced construction of this newly designed precision-made Ettco-Emrick tap chuck eliminates "whipping" action and insures greater accuracy. Light weight and small external dimensions minimize spindle inertia on reversing, making it suitable for either light, sensitive work or heavy duty jobs. Only three sizes needed to cover the complete range of tap capacities from No. 0 to 1". *For details, write Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn 37, N. Y.*

LaGuardia Airport — The Port of New York Authority Photo

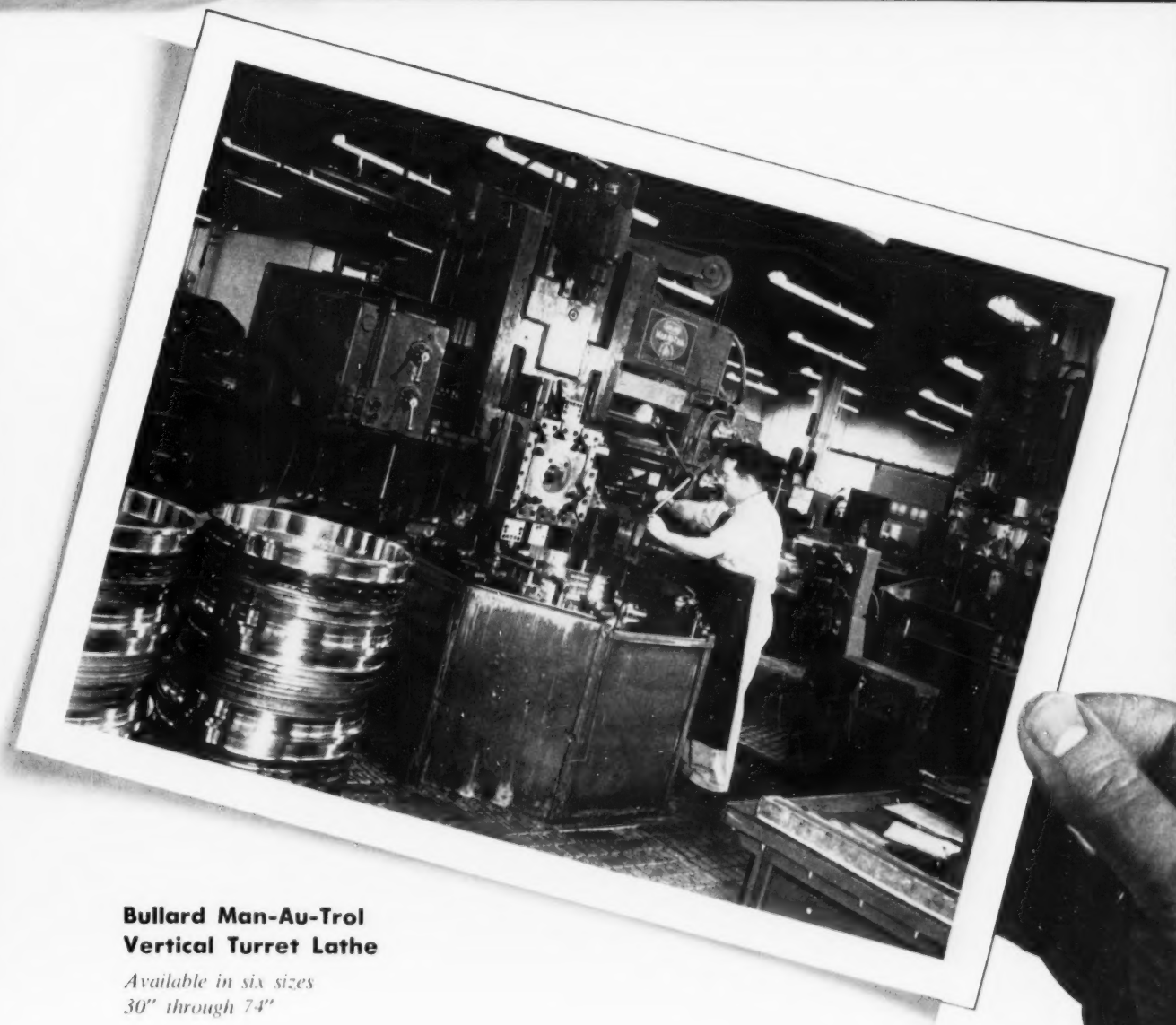
BULLARD

The Invisible Background of Industrial Progress

Travel by air is an integral part of our everyday living — both for business and pleasure. In everyday business, air transport makes it possible for personnel, materials and finished products to arrive at destinations in a mere matter of hours, when, a few years ago, the same mileage required days or even weeks. For pleasure, it enables the vacationist to reach many far-away places in less than a day — a modern "magic carpet."

To maintain and service our vast network of airlines requires tractors, luggage carts, food and fuel supply trucks — manufactured through the use of *Modern Machine Tools* — "The Invisible Background of Industrial Progress."

THE BULLARD COMPANY • BRIDGEPORT 2, CONNECTICUT

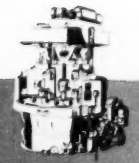


Bullard Man-Au-Trol
Vertical Turret Lathe

Available in six sizes
30" through 74"

It's the cost per cut that counts! The Man-Au-Trol Vertical Turret Lathe, because of its inherent built-in flexibility and versatility, reduces cutting costs to a minimum. The machine may be controlled either manually by the operator or entirely automatically by Man-Au-Trol.

Simple operation, minimum time for operator training, all controls within easy reach, less operator fatigue and low maintenance cost with a minimum of down time are profit plus operating factors offered by the Bullard Man-Au-Trol Vertical Turret Lathe. Ask your Bullard Representative for all the facts or write to The Bullard Company, Bridgeport 2, Connecticut — phone EDison 6-2511.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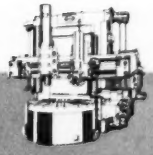
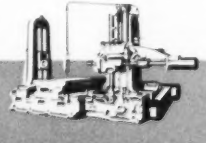
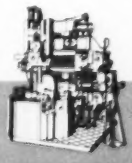

CUT MASTER


HORIZONTAL BORING

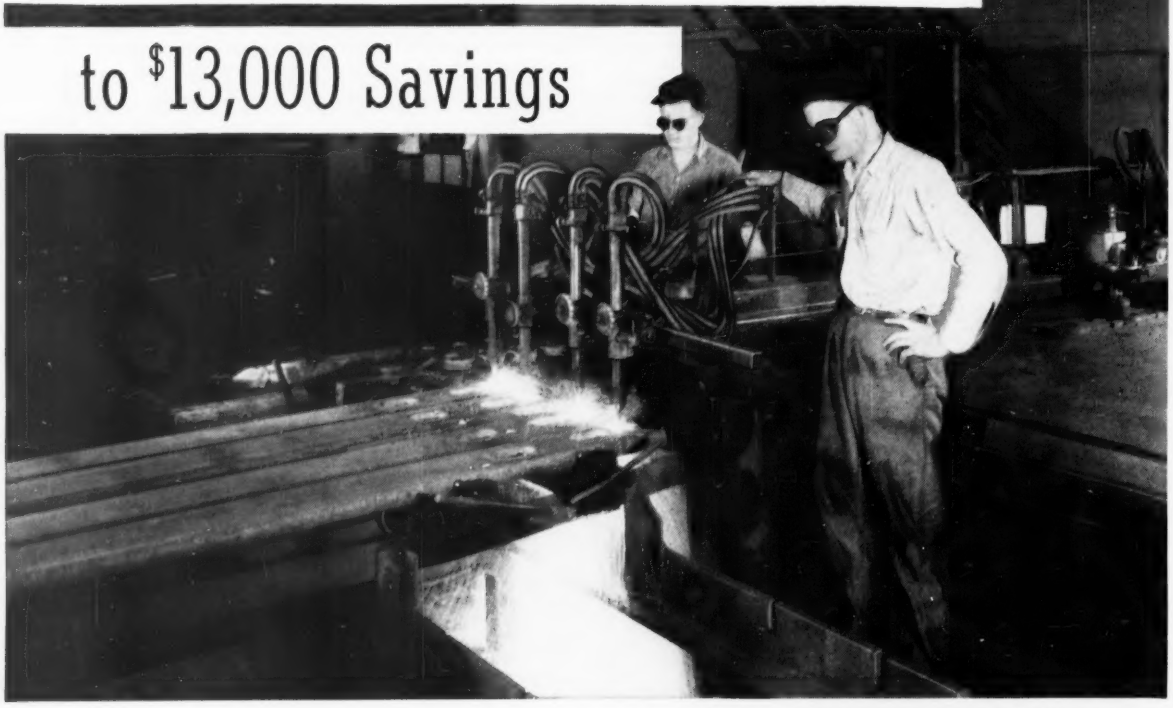
SPACER


MAN-AU-TROL

MULT-AU-MATIC

BULLARD

Machine-Cutting Clears the Way to $13,000 Savings

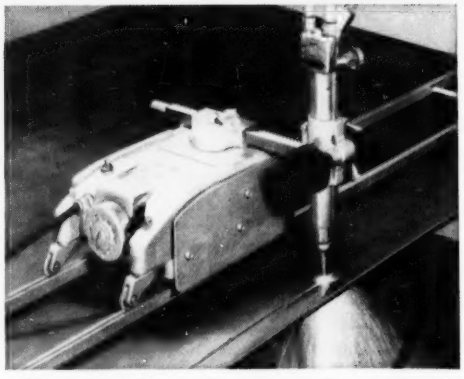


One steel company is saving up to $13,000 a year by using oxygen shape-cutting machines for making ingot and pan links from steel plate.

Previously these parts were forged at an annual cost of approximately $30,000. The speed and accuracy of oxygen shape-cutting cut costs to $17,000 a year—a savings of more than two dollars on each of the 5,000 parts made.

Machine-cutting setups are speeding fabrication and cutting costs throughout industry. Whatever your part-producing needs are—cutting hundreds of parts at one time, or one-of-a-kind turnout—there are LINDE oxygen shape-cutting machines to help you save hours and dollars in production time.

LINDE service engineers will be glad to help you determine the shape-cutting setup to best serve your job needs. Call your local LINDE representative for more information. Start saving now—call him today.



This lightweight portable cutting machine weighs only 33-lbs., and can cut metals up to 10-in. thick. It can cut straight lines, circles, and plate edge preparations in from 4-in. to 12-in. per minute.

Linde Air Products Company
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.
Offices in Other Principal Cities
In Canada: DOMINION OXYGEN COMPANY
Division of Union Carbide Canada Limited, Toronto

Linde
Trade-Mark

"Heliarc," "Unionmelt," and "Linde" are registered trade-marks of Union Carbide and Carbon Corporation.

For more information on products advertised, use Inquiry Card, page 265

COME SEE...

how Pittsburgh Purple Armored Gears are made

● That little old plant of ours at 27th and Smallman got too small for us so we went "house" hunting. Pictured above is what we found—33,000 feet of floor space with five acres of room for us to spread out. Now we'll be able to give you better service.

● New and better equipment, in addition to equipment from our old plant, is beginning to turn out Pittsburgh Purple Armored Products faster than ever. And our new, enlarged heat-treating facilities will enable us to continue to supply the high quality ARMORED and heat-treated gears ...and allied products...which have been guaranteed by Pittsburgh Gear and accepted throughout the industry as second to none...since 1914.

Come and see us when you can. Meanwhile, send us your specifications for quotation; or tell us what you need, and we'll design the gears for you. Our engineering department is at your service.

SPUR	MINING MACHINE
MITRE	GEARS
HELICAL	and
HERRINGBONE	PARTS
WORM GEARS	for
REDUCERS	LOADERS
CRANE WHEELS	CUTTERS
	LOCOMOTIVES

PITTSBURGH GEAR COMPANY

Neville Island
Pittsburgh 25, Pa.
Phone: SPaulding 1-4600

subsidiary of BRAD FOOTE GEAR WORKS, INC. • CICERO 50, ILLINOIS

GUARANTEED PITTSBURGH
ARMORED PRODUCTS
Reg. U. S. Pat. Off.

"Maintenance costs small, operators like LeBlonds..."

machine tool builder Greaves

Lineup of LeBlond Lathes at Greaves: 17" Rapid Production (foreground), seven 17" Regals and a 15" Regal. Turn precision parts for milling machines on 24 hour schedule. Dependable, versatile, accurate, cost little to maintain.

tells why he uses LeBlond lathes

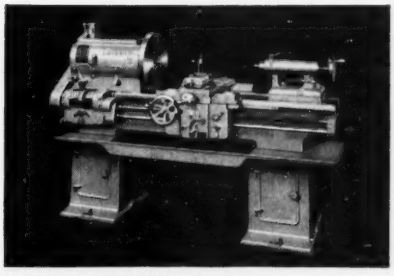
No one knows machine tools better than people who build them. And Greaves Machine Tool Company, Cincinnati, owns nine LeBlond Lathes! Eight Regals and a Rapid Production.

Since 1941, some of these lathes have worked almost 24 hours a day on full-schedule production for precision milling machine parts, woodworking machine parts and sub-contract work.

Bill Greaves himself says, "*Maintenance costs are extremely small, operators like working on their LeBlonds—because they're easy to operate, convenient, have a great deal of power for their size. Give long sustained accuracy, especially in boring and turning tapers*".

A machine tool man like Bill Greaves knows what he's looking for in a lathe. His opinion counts. When he says our lathes have what it takes, we feel it's a tribute of the highest order!

Check the variety of jobs these versatile lathes handle at Greaves. Sound like some of the parts production work in *your* shop? LeBlond Lathes can speed up jobs like these, keep your maintenance costs down to a bare minimum.

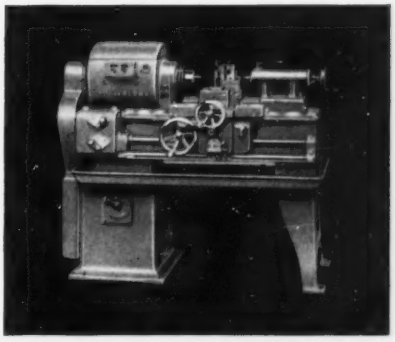


LeBlond REGAL Lathes

Light-duty lathes with heavy-duty features—ideal for production, job shop work and training. Geared headstock, quick change feed box, separate leadscrew and feed rod, taper key drive spindle nose, one-piece apron. Swings—13″, 15″, 17″, 19″, 21″, 24″, and 13″ bench model. 17″, 19″, 21″, 24″ Gap and 17″/28″ Sliding Bed Gap. Write for Bulletin R-D, stating sizes you are interested in.

Typical Jobs:

Bushings • Shafts • Armatures • Expansion arbors for mounting gears • Bevel gear blanks • Spindle for universal head • Sleeve gear blanks for Milling Machines • Tumbler for reverse drive • Formica gear blanks (laminated canvas-based gear material)



LeBlond RAPID PRODUCTION Lathes

Designed especially for low-cost high-production turning. Not a stripped-down engine lathe. Choice of headstocks gives you speeds within the range you choose. Swings—13″, 17″ and 20″. Write for Bulletin RP-D, stating sizes you are interested in.

THE R. K. LEBLOND MACHINE TOOL CO., CINCINNATI 8, OHIO

Your nearby LeBlond Distributor will give you all the facts. Call him soon, or write.

turned faster by

LeBLOND *of Cincinnati*

WORLD'S LARGEST BUILDER OF A COMPLETE LINE OF LATHES—FOR OVER 64 YEARS.

For more information on products advertised, use Inquiry Card, page 265

No matter what your tool requirements may be — no matter how often tools must be changed—Beaver Quick-Change Tool Holders and Adaptors will save you money.

Beaver's versatile Quick-Change Tooling permits the use of shell mills, face mills, end mills, drills, reamers, boring bars and other desired tools on any Beaver equipped machine without loss of accuracy.

Less than ten seconds per tool change gives you maximum production from each machine. Down-time reduced to an unbelievable minimum.

Beaver Quick-Change Tooling can be installed on most standard machines. Let us show you how it will benefit YOUR machine operations.

Write for our complete catalog #52.

Beaver TOOL AND ENGINEERING CORPORATION

2850 ROCHESTER ROAD • BOX 429, ROYAL OAK, MICH. Teletype - Big Beaver 648

For more information on products advertised, use Inquiry Card, page 265

Here's why a press builder installs Farval when he wants foolproof lubrication

Studies in Centralized Lubrication
No. 152

ONE bearing missed by grease gun or oil can and the finest press can be out of production. To avoid this possibility, the builder of these newly-designed Cleveland power presses in a famous appliance maker's mid-western manufacturing plant installed modern lubrication systems—Farval!

Farval Eliminates Lubrication Downtime

Farval is the foolproof Dualine system of centralized lubrication that hydraulically delivers a measured amount of clean lubricant at regular intervals to all bearings, *never missing any.* In this way, downtime due to hit-and-miss lubrication is completely eliminated. To lubricate an average press with Farval takes only one minute *while the press is in operation!* Compare this to the 15-20 minutes it takes each time to lubricate by hand.

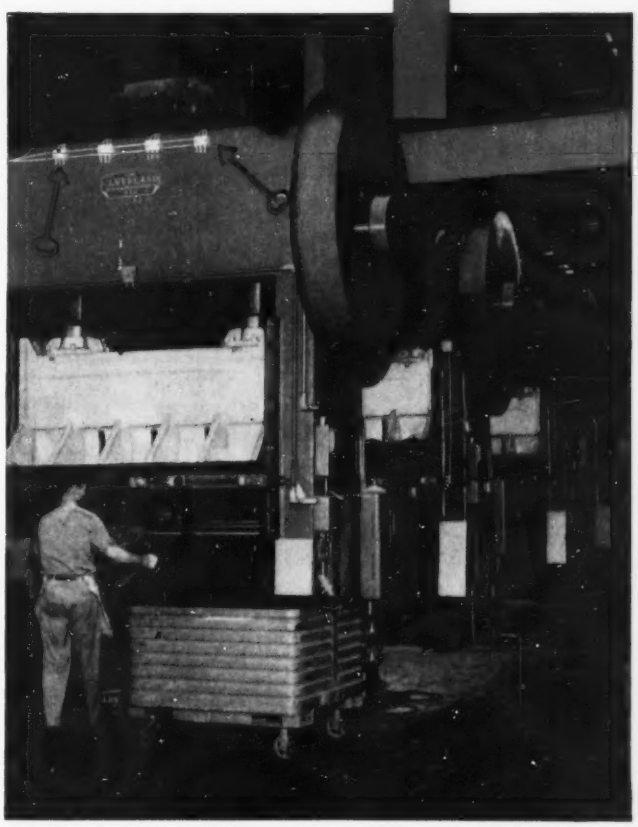
Saves up to 75% Lubricant

The moment you install Farval, you start to save up to 75% of former lubricant consumption. Not only that, but you also get rid of splashes of dangerously slippery grease or oil because Farval is a safe, completely enclosed system.

Press builders prefer Farval because the Farval Dualine valve is simple and sure, with wide ports engineered to deliver the *exact* amount of lubricant required. There are no uncertain springs, ball-checks or pinhole ports to cause trouble. With only two moving parts, the Farval measuring valve is trouble-free! Indicators at every bearing show *positive proof* that each valve has functioned.

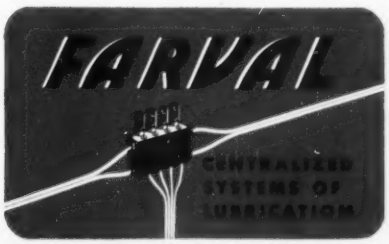
Why not give your presses the life insurance they need? Install Farval! Write for Bulletin 26. The Farval Corporation, 3276 E. 80th St., Cleveland 4, O.

Affiliate of The Cleveland Worm & Gear Company, Industrial Worm Gearing. In Canada: Peacock Brothers Limited.



KEYS TO ADEQUATE LUBRICATION—Wherever you see the sign of Farval—the familiar valve manifolds, dual lubricant lines and central pumping station—you know a machine is being properly lubricated. Farval manually operated and automatic systems protect millions of industrial bearings.

Battery of 8 presses equipped with Farval in the shop of a large kitchen-range manufacturer. Photo courtesy of The Cleveland Punch & Shear Works Co.



For more information on products advertised, use Inquiry Card, page 265

From Sinclair Research Comes

An IMPROVED hydraulic oil

SINCLAIR DURO

4 vital inhibitors assure protection against rust – oxidation – foam

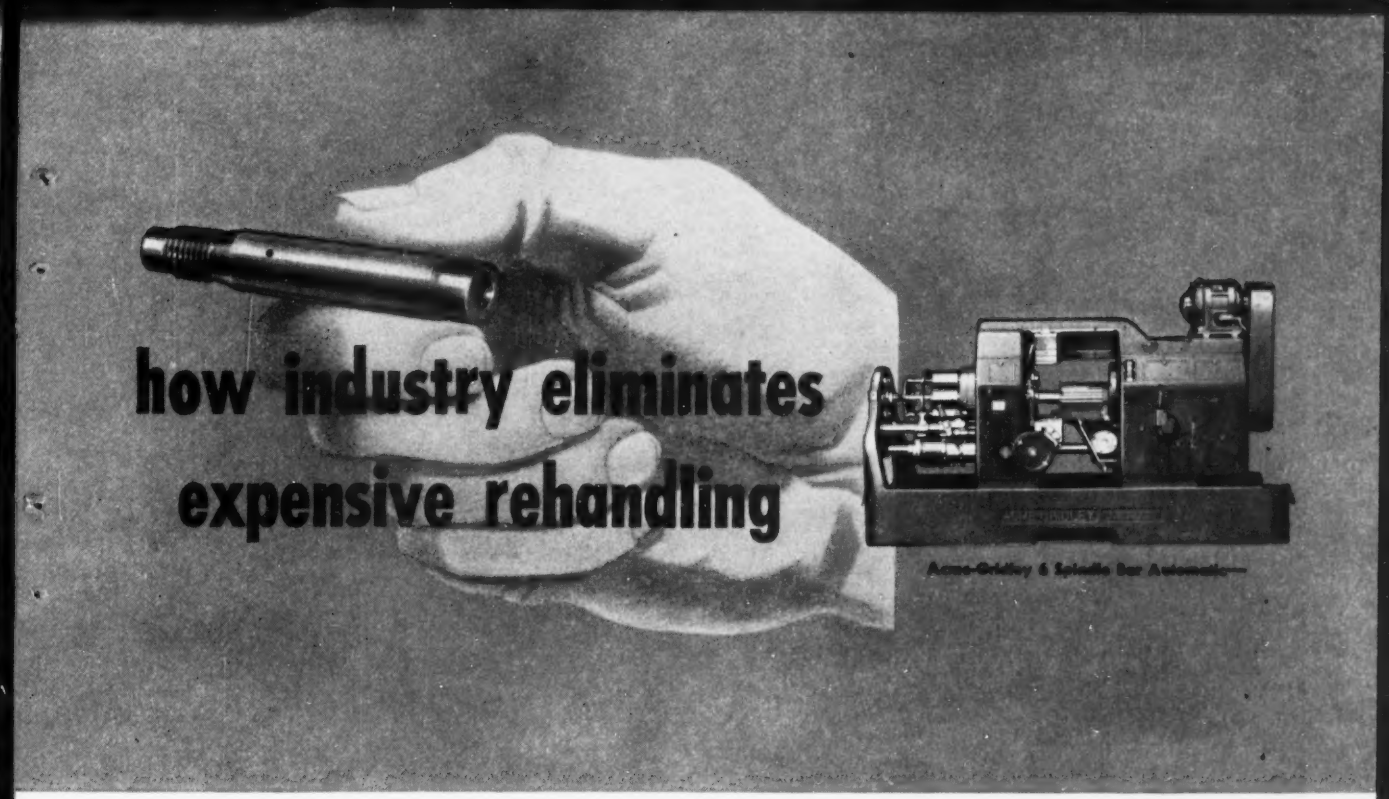
Sinclair DURO Hydraulic and Machine Oil was developed by Sinclair's Research Laboratory, Harvey, Illinois, to meet the requirements and demand for a quality hydraulic oil – an oil which would assure sensitive hydraulic system control and operation.

Sinclair DURO Oils have *unusually high oxidation resistance* to combat corrosive materials, varnish and sludge formation. The inclusion of Sinclair's rust inhibitor *protects metal surfaces* against rusting in systems where frequent shutdown causes moisture condensation. Sinclair's rust inhibitor "plates out" on a metal surface for maximum rust prevention. Moreover, Sinclair DURO Oils have *extremely effective anti-foam characteristics* which prevent foam-promoting air bubbles from remaining in suspension.

These are only some of the reasons why Sinclair DURO Oils permit smoother, full-powered transmission for high productivity. For further information why not call your local Sinclair Representative or write Sinclair Refining Company, 600 Fifth Avenue, New York 20, N. Y.

SINCLAIR

For more information on products advertised, use Inquiry Card, page 265



how industry eliminates expensive rehandling

with ACME-GRIDLEY Bar Automatics

Whether you "automate" or pick 'em up with your fingers, you're going to have a certain amount of handling in making any product. But, the less *re*handling—the faster the job is done and the lower the cost per piece.

That is why more and more manufacturers are getting more operations on their primary machining equipment. It's also why, every day, more intricate parts like these—and larger ones, too—are being *completed in one setup* on multiple spindle Acme-Gridley bar machines.

Ingenious tooling of these versatile machines with standard National Acme toolholders and attachments often eliminates second operation work entirely—saves not only handling, but also extra machines, floor space and valuable man-hours. And in addition, the parts are more accurate because you don't have to re-chuck.

Check your machining methods today—then ask your engineers and ours to talk it over.

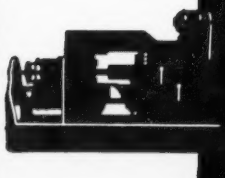
Remember—the biggest help to your competition is your continued use of obsolete equipment.

ON JOBS LIKE THESE

DRILLED STUD $\frac{3}{8}$" diameter, $2\frac{1}{4}$" long.
MATERIAL: B-1113 CD Steel.
OPERATIONS: 12 including rolled thread and spindle stopper for cross drilling to blind hole.
MACHINE TIME: 9 seconds (400 completed pieces per hour.)
(Formerly done in two setups)

WORM $\frac{3}{8}$" diameter, $1\frac{3}{4}$" long.
MATERIAL: B-1113 CD Steel.
OPERATIONS: 9 including machining the worm and broaching end of piece.
MACHINE TIME: 8 seconds (450 per hour.)
(Formerly done in three setups)

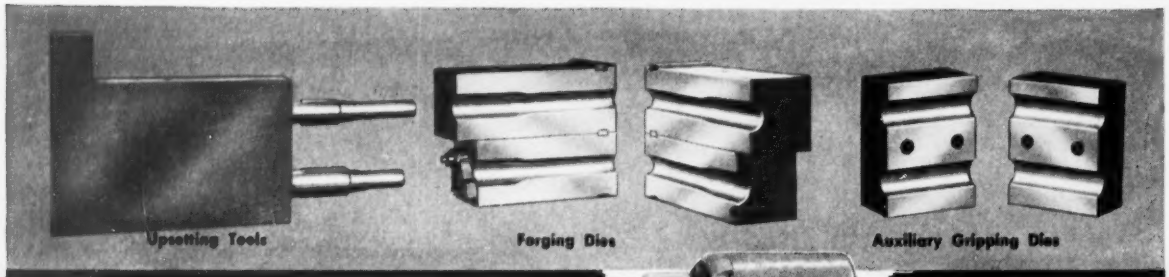
Ask for Catalog M-450



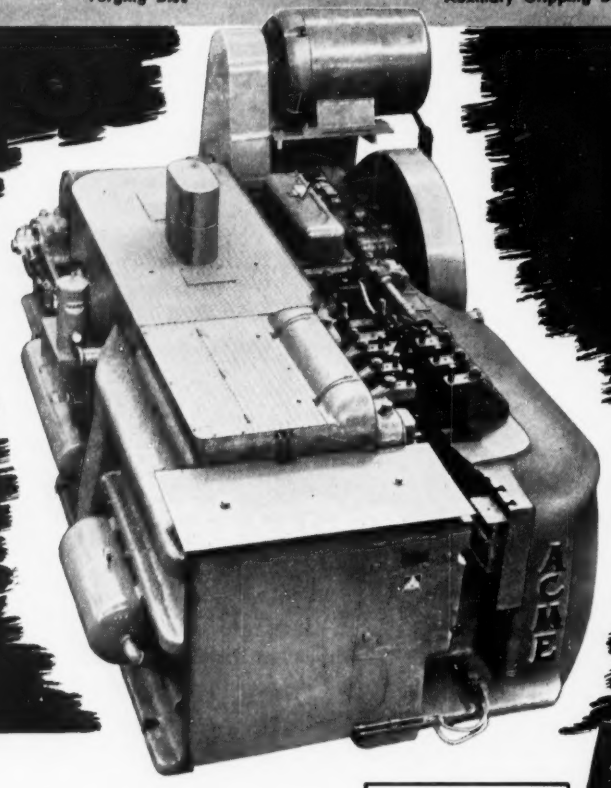
The NATIONAL ACME COMPANY

170 EAST 131st STREET • CLEVELAND 8, OHIO

Acme-Gridley Bar and Chucking Automatics: 1-4-6 and 8 Spindle Hydraulic Thread Rolling Machines • Automatic Threading Dies and Taps • Limit, Motor Starter and Control Station Switches • Solenoids • Contract Manufacturing.



TUBE UPSETTING with an ACME XN FORGING MACHINE



This 4" ACME XN Forging Machine is adapted for upsetting steel pipe or tubing, thickening the tube wall at the ends so that it can be threaded. An auxiliary gripping attachment holds random lengths of tubing during the upsetting operation. Basic features of ACME XN design are retained to insure maximum efficient operation on long production runs. While principally used in the oil well industry, other profitable applications of this special equipment are apparent.

A.P.I. tube upset for OIL FIELDS from 4" ACME XN Forging Machine. Est. production—300 per Hr.

THE HILL ACME COMPANY

ACME MACHINERY DIVISION • 1203 W. 65th St., Cleveland 2, Ohio
ESTABLISHED 1882

"ACME" FORGING • THREADING • TAPPING MACHINES • ALSO MANUFACTURERS OF "HILL" GRINDING AND POLISHING MACHINES
HYDRAULIC SURFACE GRINDERS • "CANTON" ALLIGATOR SHEARS • PORTABLE FLOOR CRANES • "CLEVELAND" KNIVES • SHEAR BLADES

For more information on products advertised, use Inquiry Card, page 265

SO YOU DON'T NEED GAGES?

Here is a job where cylindrical Plug Gages are saving man hours.

These plated brace "sweeps" will go from here to final assembly.

Formerly final assembly involved a lot of selection and fitting. Now, thanks to this gaging operation, the final assemblers *know* they'll fit. No more selection — no more fitting — yet faster assembly.

Got a job that "Don't need Gages"? Let us survey it for you without obligation, it may save you money.

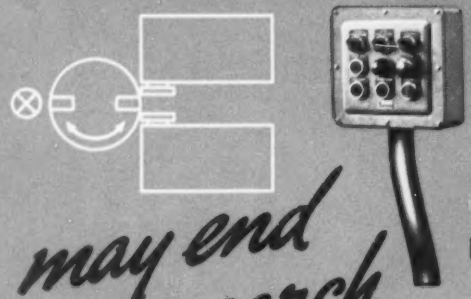
GREENFIELD TAP AND DIE CORPORATION

GREENFIELD, MASS.

Duplex Milling

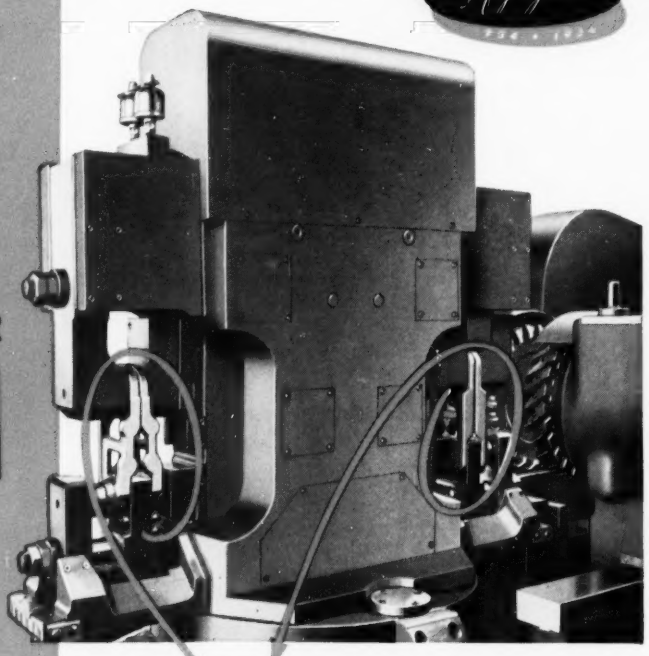
as Engineered by

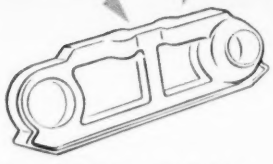
MOTCH & MERRYWEATHER



may end your search

Tifty Years

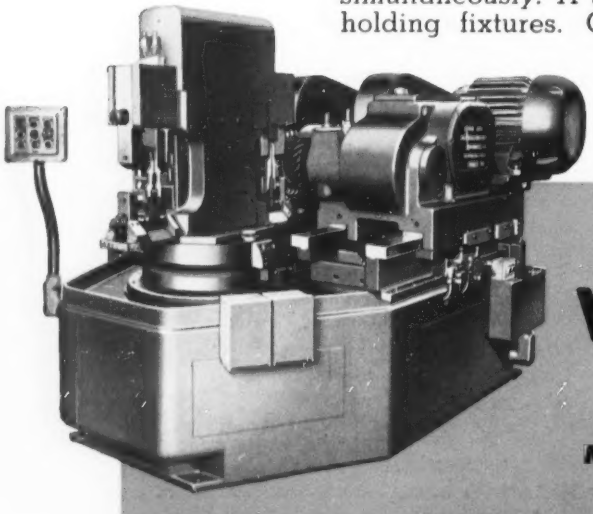




Both sides of tractor side bars are face milled. Production is 240 pieces per hour using high speed steel cutters.

PRODUCTION CAN BE RAISED 50%
by Motch & Merryweather's *Duplex Milling Method!*

• Production milling is given new meaning by Motch & Merryweather's duplex method. Two heads mill two parts *simultaneously.* A table indexing 180° has two sets of work-holding fixtures. One operator unloads and loads during *duplex milling* at the opposite fixture. Fully automatic operation sets new production limits. Consult Motch & Merryweather about your production milling.



THE MOTCH & MERRYWEATHER MACHINERY CO.

MACHINERY MANUFACTURING DIVISION

CLEVELAND 13, OHIO

Builders of Circular Sawing Equipment, Production Milling, Turning and Special Machines

For more information on products advertised, use Inquiry Card, page 265

ELECTRICAL CONDUIT

PERMANENT
EASILY INSTALLED
LIQUID-TIGHT
FLEXIBLE
APPROVED

SEALTITE (TYPE U.A.) is approved by Underwriters' Laboratories, Inc. for use where exposed to moisture or mineral oils (up to 60C). See N.E. Code, Art. 351.

SEALTITE
ELECTRICAL CONDUIT PROTECTS WIRING

against oil, grease, water, dirt, chemicals, corrosive fumes, salt spray, weather

SEALTITE* is a flexible *and* liquid-tight electrical conduit. It gives maximum protection to your wiring when it must connect moving parts, absorb vibration, follow machine contours, flex into U-bends, be easily maintained or be safeguarded between misaligned ports.

It is being used successfully in wet locations, in tunnels, power plants, steel mills, canneries, chemical industries and in many outdoor applications. SEALTITE comes in two types:

TYPE U. A.—UL-approved. Made with flexible galvanized steel core, positive ground and tough outer cover.

NOM. I.D. (Inches)	INSIDE DIA. (Inches)		OUTSIDE DIA. (Inches)		APPROX. INSIDE BEND DIA. (Inches)	EST. WEIGHT per hundred ft. (Pounds)
	Min.	Max.	Min.	Max.		
⅜	.484	.504	.690	.710	8	30.0
½	.622	.642	.820	.840	10	36.6
¾	.820	.840	1.030	1.050	15	48.2
1	1.041	1.066	1.290	1.315	18	87.7
1¼	1.380	1.410	1.630	1.660	21	116.5

TYPE E. F.†(Extra Flexible)—for machine tools and industrial equipment. (Meets standards set by J.I.C.) †Pat. Applied For

NOM. I.D. (Inches)	INSIDE DIA. (Inches)		OUTSIDE DIA. (Inches)		APPROX. INSIDE BEND DIA. (Inches)	EST. WEIGHT per hundred ft. (Pounds)
	Min.	Max.	Min.	Max.		
⅜	.485	.505	.690	.710	5	24.3
½	.620	.640	.820	.840	6	29.0
¾	.815	.835	1.030	1.050	9	38.2
1	1.025	1.055	1.290	1.315	10	65.0
1¼	1.365	1.395	1.630	1.660	13	84.4
1½	1.575	1.605	1.870	1.900	15	122.0
2	2.020	2.055	2.335	2.375	17	158.0
2½	2.480	2.515	2.840	2.875	20	205.0
3	3.070	3.110	3.460	3.500	27	290.0
4	4.000	4.050	4.460	4.500	34	430.0

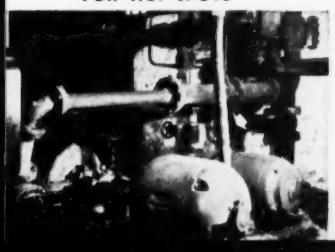
Commercial tolerances apply on above figures.

ELECTRICAL WHOLESALERS stock both types. Buy it in long random lengths as shown; then cut without waste. Or ask your wholesaler to cut the length you need. Liquid-tight connectors are available from wholesalers' stocks. Write for Bulletin UA-531. *The American Brass Company, American Metal Hose Branch, Waterbury 20, Conn.*

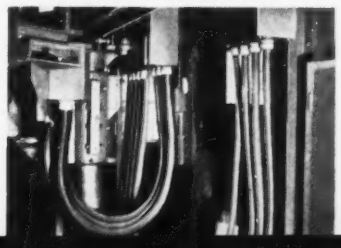
*Trade Mark 54177

SEALTITE flexible, liquid-tight electrical conduit an **ANACONDA®** product

FOR WET SPOTS

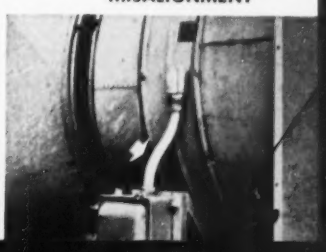


MOVING CONNECTIONS



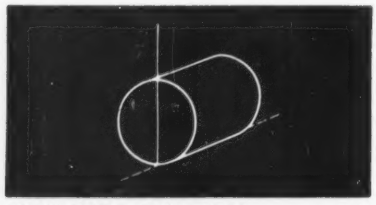
OUTDOORS

MISALIGNMENT



Rollways ROLL right because they're MADE right

RIGHT ANGLE DESIGN
increases bearing efficiency



RIGHT-ANGLE ROLLER ENDS . . . precisely square to avoid end rub, oscillation and side-shock.

RIGHT-ANGLE BEARING SURFACE . . . precisely parallel to promote unwavering rightline rolling.

RIGHT-ANGLE SEPARATOR SLOTS . . . precisely machined to prevent roller skew, slide and uneven wear.

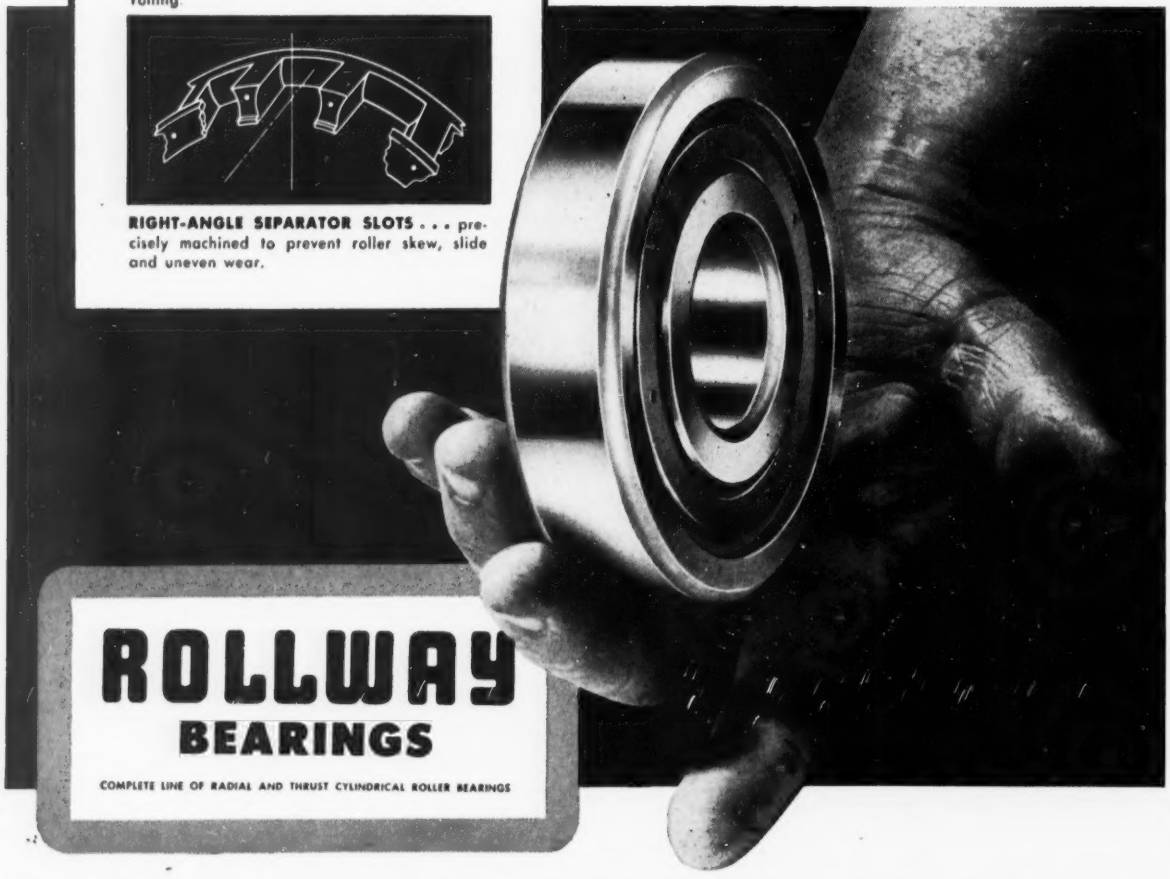
Line for line and surface for surface, each maximum-load type Rollway Bearing is a striking example of right-angle trueness. The straight, solid cylindrical rollers provide maximum contact area in any given dimension. You get full load-carrying capacity and greater ability to absorb shocks, vibration and overload.

The net result is smoother running, longer life, reduced service cost, and less down-time due to bearings.

ROLLWAY BEARING CO., INC.
SYRACUSE 4, N. Y.

• Our engineers will gladly work with you on your bearing problems. Confidential consultation. No charge — no obligation.

Rollway Bearing replacements are available through authorized distributors in principal cities. Consult your classified phone directory.



ROLLWAY
BEARINGS

COMPLETE LINE OF RADIAL AND THRUST CYLINDRICAL ROLLER BEARINGS

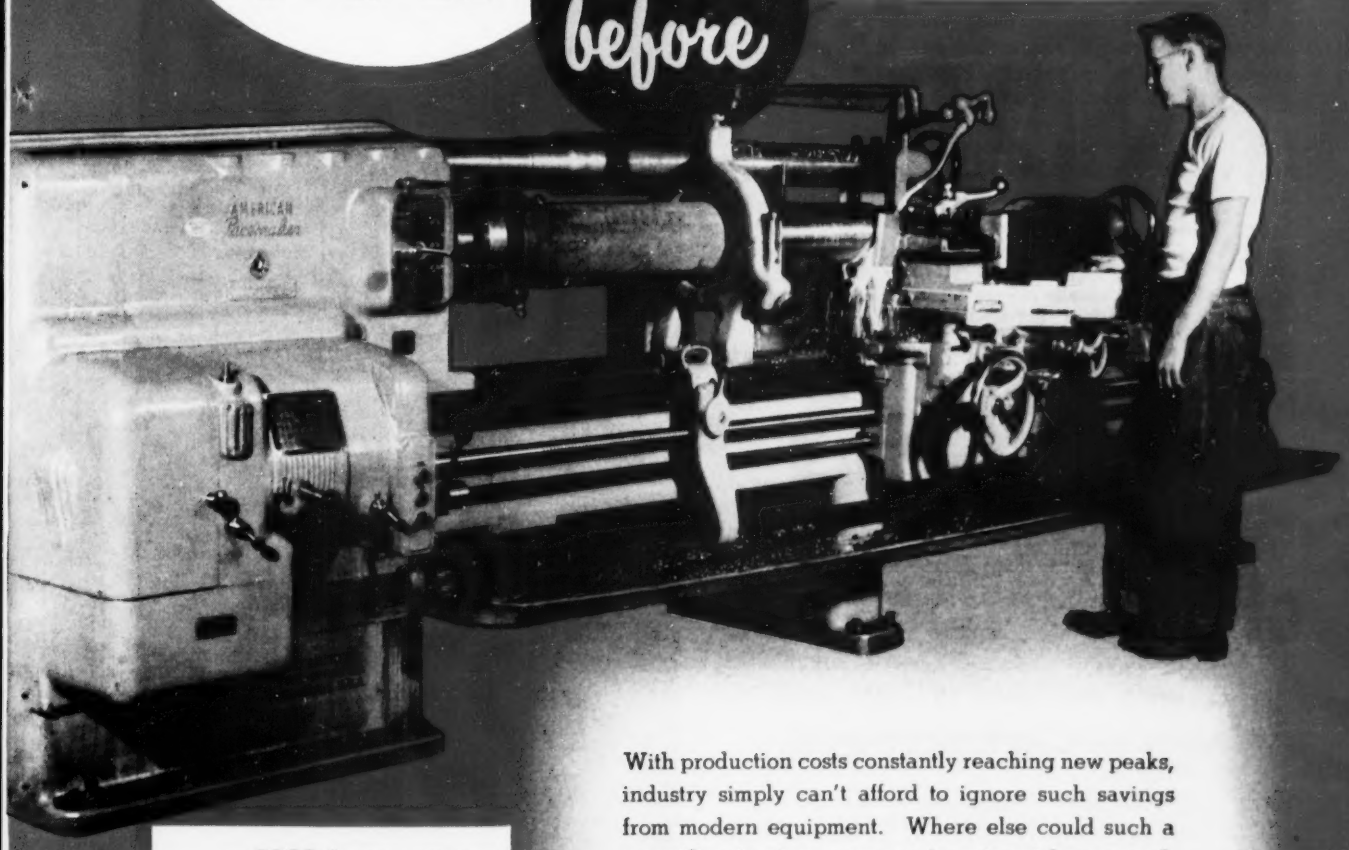
SALES OFFICES: Boston • Detroit • Milwaukee • Syracuse • Chicago • Houston • Philadelphia • Toronto • Cleveland • Los Angeles • Pittsburgh • San Francisco • Seattle

For more information on products advertised, use Inquiry Card, page 265

2¼ hrs. now

9 hrs. before

Fairbanks, Morse & Co., Beloit, Wisconsin, is *really* putting the payroll dollar to work with its new 20 inch "AMERICAN" Heavy Duty All-Hydraulic Duplicating Lathe.



2000 horse power Fairbanks-Morse motor shafts are now being rough and finished turned in 2¼ hours floor to floor against a former time of 9 hours per shaft.

With production costs constantly reaching new peaks, industry simply can't afford to ignore such savings from modern equipment. Where else could such a magnificent return upon an investment be secured, and how else can costs be lowered to meet an increasingly competitive market?

More production per man hour is the answer and the only answer to prohibitive costs—modern, high production machinery is the answer to greater production per man hour.

Put your payroll dollar to work for greater profits with "AMERICAN".

Bulletin No. 35 shows many examples—it's yours for the asking.

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

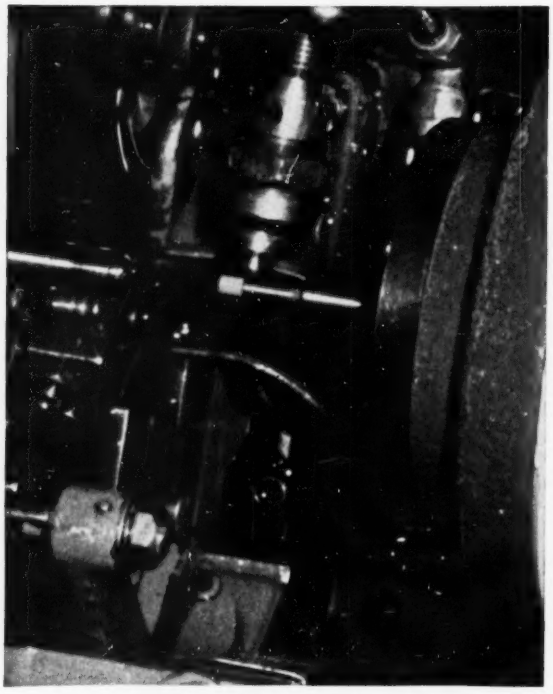
HOW TO SAVE HOURS

of Production Time

***...with Mounted Wheels and Points by* CARBORUNDUM**

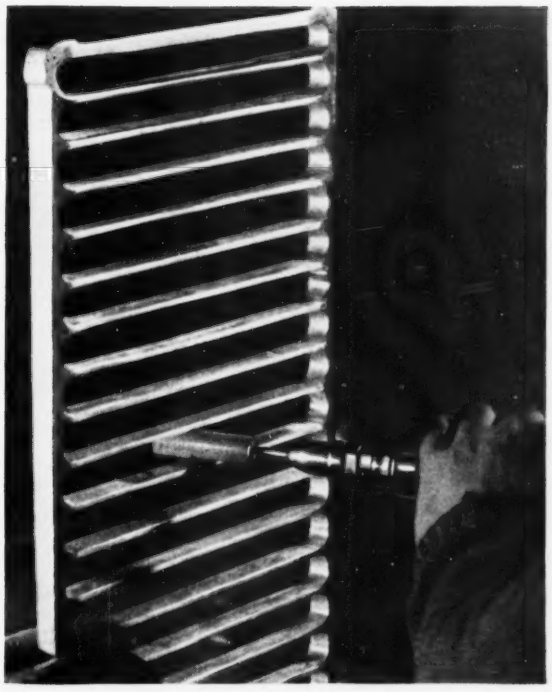
Seconds saved in one operation on your production line soon add up to hours ... and it will pay you to study your grinding and finishing jobs to see how many can be speeded by using Mounted Wheels and Points by CARBORUNDUM. They are famous for "chopping" seconds—for eliminating slow, tedious hand finishing operations and for speeding every internal grinding job.

Rough or finish any surface—curved or flat.

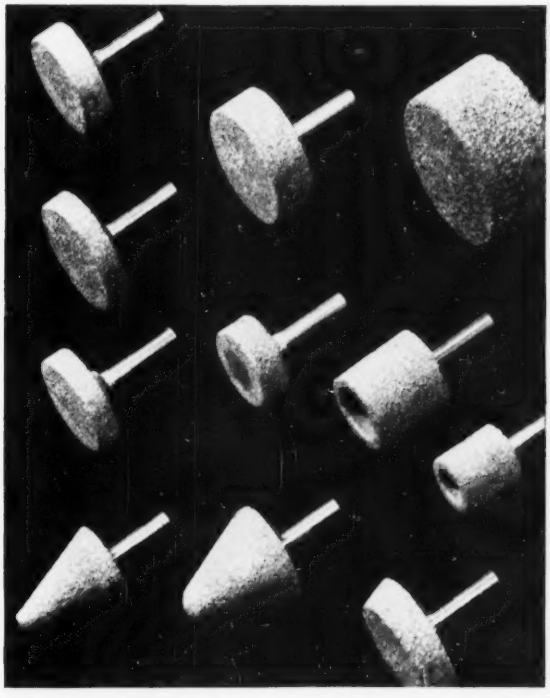


Fast, economical for internal grinding.

...continually putting more sense in your abrasive dollar



Deburring is fast with Mounted Wheels.



Choice of shapes, sizes to speed portable grinding.

WITH HIGH SPEED PORTABLE EQUIPMENT and CARBORUNDUM's Mounted Wheels you can rough or finish grind, deburr, chamfer, break corners . . . perform dozens of tasks fast, safely. The wide choice of shapes and sizes permits grinding and finishing on any surface — flats, contours, hard-to-reach areas, inside diameters of all types.

FOR INTERNAL GRINDING, TOO— whether you use a single purpose machine, a tool and cutter grinder or a tool post grinder — you'll find Mounted Wheels and Points by CARBORUNDUM tops in speed, efficiency and economy.

USE ALUMINUM OXIDE MOUNTED WHEELS on materials of high tensile strength — plain and alloy steel, high speed steel, annealed malleable iron, hard bronze. Use silicon carbide mounted wheels on materials such as cast iron, brass, bronze, aluminum and many non-metallics.

● **YOUR CARBORUNDUM DISTRIBUTOR OR SALESMAN** will gladly show you how these cost-cutters can best serve you. He's listed in the yellow pages under "Abrasives" or "Grinding Wheels." Or send the coupon for your FREE copy of "Mounted Wheels and related Abrasive Products" — a 32-page booklet which gives you complete information on mounted wheel sizes, shapes, grains, bonds and mandrels for portable and internal grinding. There's a section on popular MX® Mounted Wheels . . . which finish as they cut; and a section on Coated Abrasive Products for portable grinding. Grading recommendations are included for many operations.

SEND TODAY!

THE CARBORUNDUM COMPANY, Dept. M 81-48
Niagara Falls, New York

Please send your booklet, "Mounted Wheels and related Abrasive Products" to:

NAME

COMPANY

STREET AND NUMBER

CITY ZONE STATE

CARBORUNDUM

REGISTERED TRADE MARK

81-48

With saucer grinding wheel, new B&D Sander-Grinder smooths welds, cuts off studs, removes rivets . . .

Equipped with wire-cup brush, Sander-Grinder removes old paint, rust, scale, dirt from tanks, boilers . . .

With B&D Planer Head, Sander-Grinder rough-finishes wood, removes stencil marks from crates . . .

NEW B&D Sander-Grinder with 90% MORE POWER to Sand, to Grind, to Cut, to Brush!

Black & Decker's *new* 7-inch Heavy-Duty Sander-Grinder has almost *twice* the power of any previous model, it offers higher spindle speeds — your choice of 5,200 or 6,000 rpm — and becomes a more nearly *universal* tool for your shop or plant! Use it for continuous, heavy-duty production . . . and get faster schedules, more output per tool! A B&D-built universal motor, specially designed just for this tool, is your guarantee of 'round-the-clock production. Motor housing is protected from even abnormal abuse, and is contoured to direct exhaust air *away* from operator. Switch-guarded against accidental operation; ball bearings lubricant-sealed. Complete with pad, three sanding discs, all ready to *go*, for only $79.50! See the new B&D Sander-Grinder at your distributor's today, or write for *Free* Form No. 27. Address: THE BLACK & DECKER MFG. CO., Dept. 605, Towson 4, Maryland.

For nearest distributor, see "Tools-Electric"

LEADING DISTRIBUTORS EVERYWHERE SELL

Black & Decker

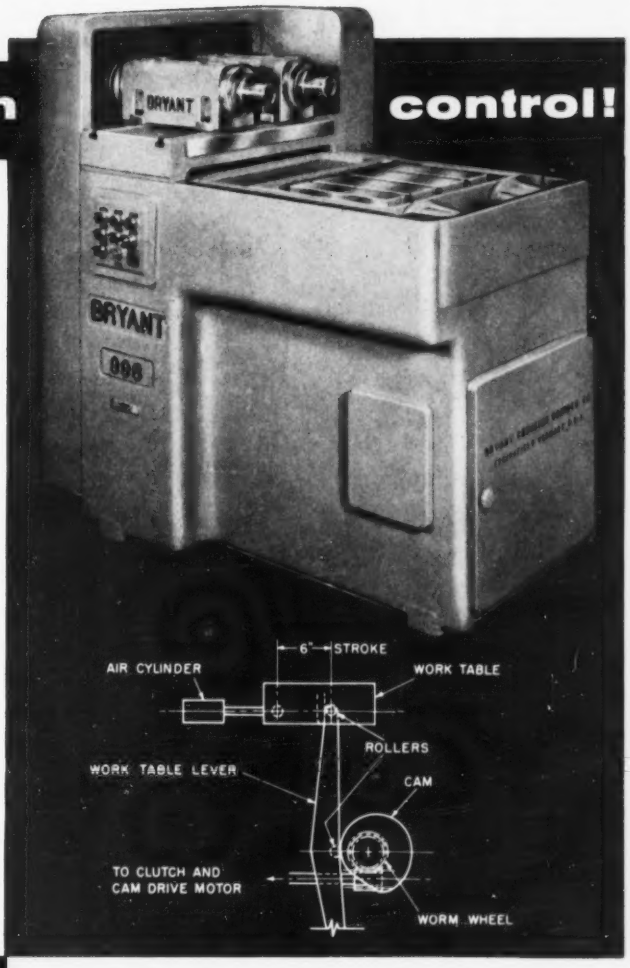
PORTABLE ELECTRIC TOOLS

B&D

For more information on products advertised, use Inquiry Card, page 265

repetitive accuracy
high speed production
and fine finishes

...with push button control!



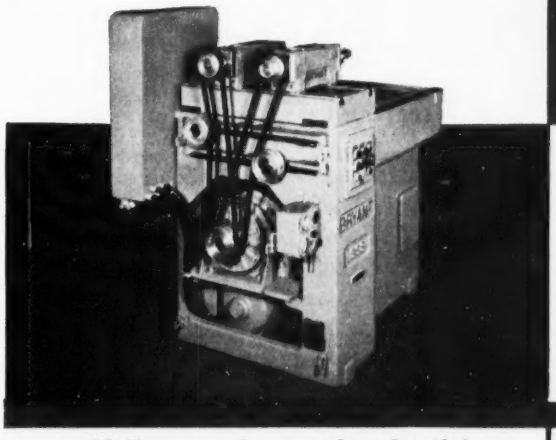
BRYANT 6" STROKE *all Mechanical* BORING MACHINE

This new Bryant 998 Boring Machine gives you fine finish and rapid production in precision boring, drilling, turning, facing, grooving, and contour turning and boring.

The cycle can be fully automatic and controlled with a single push button, or the operator can control any phase of the cycle manually.

To assure highest repetitive accuracy, the constant feed table on this boring machine is mechanically actuated by a cam and lever.

The wide bridge can accommodate as many as four boring heads of the smallest (209) bearing size. The 5 HP boring head motor provides ample power for driving the heads. Both the cam drive and the boring head motors are mounted in a well ventilated cavity in the bed.



SPECIFICATIONS

Total table stroke	6"
Top of table to top of bridge	4"
Width of bridge	27⅜"
Multiple boring heads as required by tooling to a maximum of 4 (209)heads	
Table dimensions	17½" x 22"
Floor space (without coolant tank)	31" x 54"

Mail coupon for complete details!

BRYANT Chucking Grinder Co.
SPRINGFIELD, VERMONT, U. S. A.

Internal Grinders • Boring Machines
Internal & External Thread Gages • Granite Surface Plates

BRYANT CHUCKING GRINDER CO.
SPRINGFIELD, VERMONT

Gentlemen: Please send me your Bulletin 998. M

Name.....

Title.....

Company.....

Street.....

City.....Zone.....State.....

YODER *Multiple Rotary* SLITTERS

Big Convenience, yes... but Savings are BIG, too!

Ask any owner of a Yoder slitter. He is apt to mention first the big *convenience* of being able at all times to supply his own needs in slit strands, from a relatively small stock of standard width coils. He no longer has to worry about ordering slit-to-width stock far in advance in order to anticipate production needs; changing production schedules he takes in his stride because he can meet unexpected needs for special widths on a few hours' notice. Since he is independent of outside slitting service he can buy his strip supply wherever he can get the best quality, price and delivery.

All of these conveniences may make him forget to mention the direct saving in dollars and cents which in most instances are big enough to pay for the slitter installation in a year or two, often even less.

The Yoder Slitter Book is a treatise on the mechanics as well as the economics of slitter operation, with time studies, cost analyses, coil handling, scrap disposal, and other useful data. It's yours for the asking.

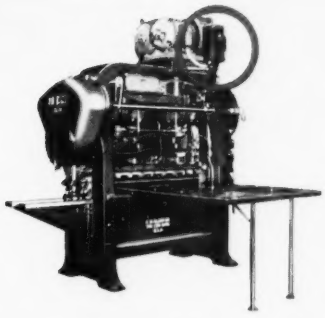
THE YODER COMPANY
5504 Walworth Ave. • Cleveland 3, Ohio

Complete Production Lines

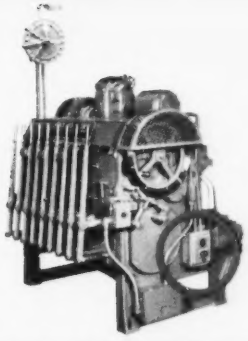
- ★ **COLD-ROLL-FORMING and auxiliary machinery**
- ★ **GANG SLITTING LINES for Coils and Sheets**
- ★ **PIPE and TUBE MILLS–cold forming and welding**

ENGINEERING YODER MANUFACTURING

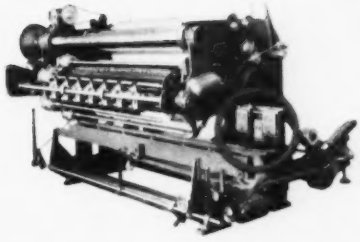
For more information on products advertised, use Inquiry Card, page 265



PERFORATING PRESS



GAS CONTROL



PAPER ROLL REWINDER

ACROSS-THE-LINE STARTERS FOR ALL TYPES OF MACHINES

A Uniform Line up to 300 HP, 220V; 600 HP, 440-550V

It is a distinct advantage to both buyer and user of motorized machines if the across-the-line starters have a family resemblance over the entire range up to 300 hp, 220 v; 600 hp, 440-550 v. For example, Allen-Bradley solenoid starters are so nearly alike over this range that to be familiar with the structure and operation of a 5 hp starter provides equal familiarity with an Allen-Bradley 500 hp starter. This advantage is limited only to the Allen-Bradley line.

Bulletin 709 solenoid starters are available in dust-tight, waterproof, explosion-proof, and corrosion-proof enclosures.

The Allen-Bradley Handy Catalog is a handbook of control information. Send for a copy.

Sizes 0 to 5

A-B Quality

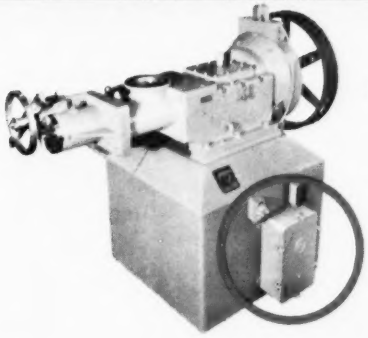
ALLEN-BRADLEY

SOLENOID STARTERS

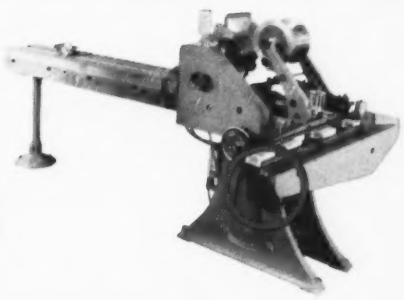
QUALITY

Allen-Bradley Co.
1316 S. Second St., Milwaukee 4, Wis

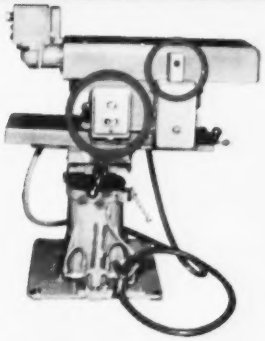
EXTRUDING MACHINE



WRAPPING MACHINE



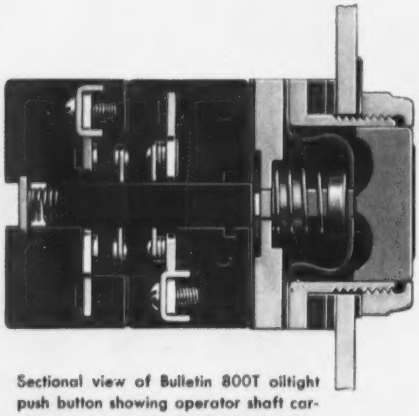
DUST REMOVER



7-54-MR

OILTIGHT PUSH BUTTONS

Start Button with Double Pole NC and NO Contacts



Sectional view of Bulletin 800T oiltight push button showing operator shaft carrying moving contacts. Stationary contacts are mounted in the molded contact block. The oiltight flexible diaphragm is between push button and contact block.

Assemble any combination of operators and contact blocks

OPERATORS

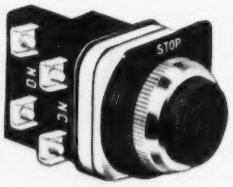
CONTACT BLOCKS

Bulletin 800T operators and contact blocks are available in many forms. They may be assembled interchangeably in various combinations, thus reducing your motor control parts inventory.

Here are a few of the many Allen-Bradley oiltight pilot units for machine tool service. They are available for mounting on machine frames in a variety of single units or in any combination of one or more units in oiltight enclosures. A flexible diaphragm, not affected by oil or cutting fluids, is inserted between button and contact block (see diagram at left) to prevent oil seepage into the contacts.

The silver alloy contacts are maintenance free. For complete information on the Bulletin 800T line, send for the new Allen-Bradley Handy Catalog.

Allen-Bradley Co.
1316 S. Second St.
Milwaukee 4, Wis.

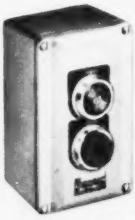


Type BA Stop Button

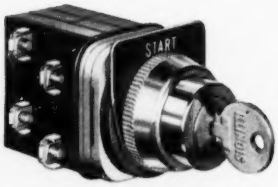
Type H2B Selector Switch

Type K2B Jog Button

Type 6PX Pendent Control



Bulletin 800T Type 2TA in Two-button Oiltight Enclosure



Type E11B Cylinder Lock Button

Type P26 Pilot Light

ALLEN-BRADLEY
QUALITY
MOTOR CONTROL

Card's 80 year record of concentration on one chief product shows up where it counts most — on your production line.

The CARD Quality

TAPS *by* CARD

Completely stocked offices at Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York, San Francisco and Seattle
See your local Card distributor for prompt deliveries and helpful service

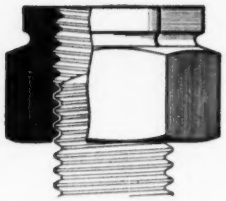
S. W. CARD MANUFACTURING CO., MANSFIELD, MASS. • DIVISION OF UNION TWIST DRILL CO. **TAPS • DIES • SCREW PLATES**

Many manufacturers use FLEXLOCS to fasten motors, compressors and other vibrating equipment to mounting plates. FLEXLOCS won't work loose . . . they eliminate costly service calls.

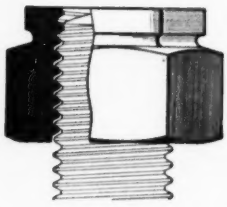
FLEXLOC locknuts reduce costly service calls

FLEXLOC locknuts do this because they stay put anywhere on a bolt as soon as their locking threads are fully engaged. Even the most severe vibration will not work them loose. FLEXLOCS offer many other advantages, too. *They are one piece.* They eliminate complicated, time-consuming methods of locking studs and bolts. They provide simpler, faster application and safer, more dependable locking than plain nuts and lockwashers, castellated nuts and cotter pins, nuts and jam nuts. They save buying, stocking and handling of extra parts. *They are all metal.* They have higher tensile strength than most other lock nuts. They permit you to stock only one nut for all temperatures to 550°F. *They are reusable.* They can be applied again and again without losing locking efficiency—a plus value in maintenance.

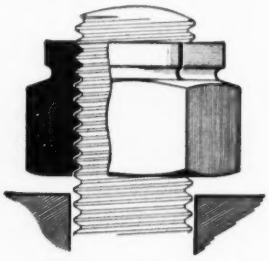
For information about FLEXLOCS and samples for test purposes, see your FLEXLOC distributor or write STANDARD PRESSED STEEL CO., Jenkintown 19, Pa.



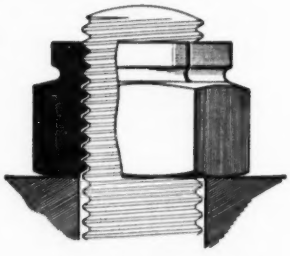
Starting. A FLEXLOC starts like any ordinary nut. Put it on with your fingers. Tighten it with a standard hand or speed wrench.



Beginning to Lock. As the bolt enters the segmented locking section, the section is expanded, and the nut starts to lock.



Fully Locked As a Stop Nut. When 1½ threads of a standard bolt are past the top of the nut, the FLEXLOC is fully locked. A FLEXLOC does not have to seat to lock.



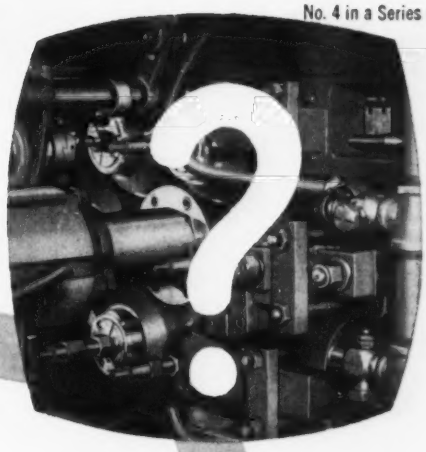
Fully Locked As a Seated Nut. When it is used as a lock or stop nut, the locking threads of the FLEXLOC press inward against the bolt, lifting the nut upward and causing the remaining threads to bear against the lower surface of the bolt threads. Vibration will not loosen a FLEXLOC, yet there is no galling of threads.

FLEXLOC® LOCKNUT DIVISION

sps
JENKINTOWN PENNSYLVANIA

For more information on products advertised, use Inquiry Card, page 265

No. 4 in a Series



What's in it for you

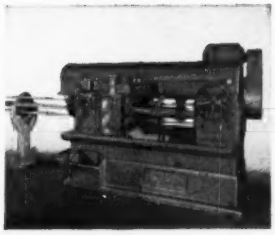
Before you buy your next multiple spindle automatic bar machine it will pay to ask your Cone Representative about the Conomatic Carbide Development program. He will be glad to tell you what's in it for you.

Among the things that your Representative can tell you is how you can be sure that any brand of "automatic", that you may have under consideration, will be equipped to get the most from any modern tool material, including 100% carbide tipped tool applications.

The part illustrated is from regular production runs with HSS and 100% carbide tipped tools. Full particulars are available.

MATERIAL—COPPER: Hole drilled with ½" dia. drill to 3" depth; taper formed on OD.

	HSS	CARBIDE
Cycle Time	45 secs.	16 secs.
Work Spindle Speed	670 R.P.M. at 110 S.F.	2026 R.P.M. at 398 S.F.
Tool Wear	150 pcs. per grind	2500 pcs. per grind



Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC.
WINDSOR, VT., U.S.A.

KELLER TOOLS "button up"

461 assemblies an hour

all day long!

Two workers make a team in assembling parts for automobile horns. Above, the screws are started which attach assemblies of stacked parts to the horn yoke. At left, the two screws are run down and tightened. Both workers use Keller Pneumatic Screw Drivers, and together they assemble at the rate of 461 units per hour.

Sustained high production rates result from providing workers with easy-to-handle Keller Air Tools engineered to the job. Waste motions are eliminated, fatigue is reduced, and production speeds are maintained hour after hour.

Keller application engineers, located in principal cities from coast to coast, have the training, know-how, and experience to select the correct tool for the job. They have a much wider selection of attachments, fittings, pickups, and finders from which to choose . . . plus the backing of design engineers ready and able to provide special adaptations or special tools if needed.

Have you talked to the Keller man, lately?

These are a few of the many Keller Screw Drivers:

KELLER

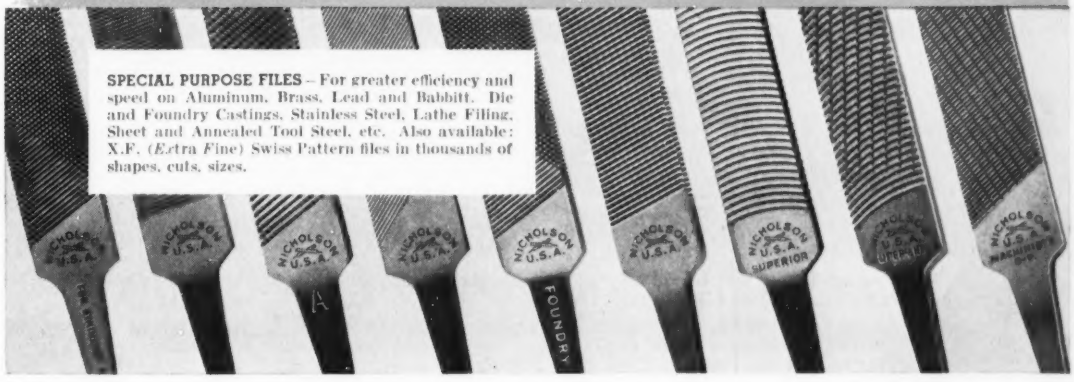
Pneumatic Tools

KELLER TOOL CO.

1307 Fulton Street
Grand Haven, Michigan

For more information on products advertised, use Inquiry Card, page 265

QUALITY PROVED BY PERFORMANCE


SPECIAL PURPOSE FILES – For greater efficiency and speed on Aluminum, Brass, Lead and Babbitt, Die and Foundry Castings, Stainless Steel, Lathe Filing, Sheet and Annealed Tool Steel, etc. Also available: X.F. (Extra Fine) Swiss Pattern files in thousands of shapes, cuts, sizes.
NICHOLSON U.S.A.
NICHOLSON U.S.A. SUPERIOR
NICHOLSON U.S.A. FOUNDRY

THERE's no mistaking a champion—in any field. By their cleanness, straightness and other outward appearances, Nicholson and Black Diamond brands immediately reflect their leadership in files. But it is in their *performance* that the industrial user discovers their even more important points of superiority.

Performance brings out what it has taken four generations of file manufacturing to put into them . . . the high efficiency of their correctly shaped and accurately cut teeth, their scientifically determined and uniform hardness, their high-quality special-analysis steel—for instance.

Constant engineering research and study have also kept Nicholson right in stride with the forward movements in shop practices and materials, as evidenced by many Nicholson developments in Special Purpose and Swiss Pattern (X.F. brand) files.

Thus, Nicholson is always alive and alert toward giving you the broadest and most comprehensive file service and the utmost in file values*.

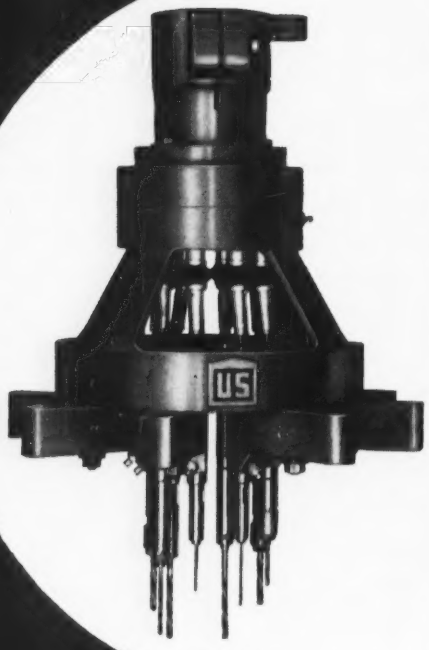
Buy Through Your Industrial Distributor

Send for *"FILE FILOSOPHY" for a comprehensive picture of the products of the world's foremost file manufacturer. It also tells about kinds, use and care of files in general. Invaluable to purchasing and production heads. FREE.

NICHOLSON FILE CO., 18 Acorn St., Providence 1, R. I.
(In Canada: Nicholson File Company of Canada Ltd., Port Hope, Ontario)

REGULAR PURPOSE FILES – In all the multitude of types, cuts and sizes for industrial, machine shop and saw-filing requirements. Also available: a complete line of Rotary Files and Burs in high-speed steel and carbide.
NICHOLSON FILES
FOR EVERY PURPOSE
NICHOLSON U.S.A.
BLACK DIAMOND
MADE IN U.S.A.
TRADE X·F MARK

KEEPING UP WITH THE JONESES



U-1

U-2

The "Joneses" and the companies they own save money, time and effort by relying on "US" Adjustable Multiple Spindle Drill Heads with *QUICK-CHANGE* universal joint assemblies.

We give the "Joneses" and you —immediate delivery.

The U-1 Head—two to eight spindles—can be adjusted to a minimum distance between spindles of 11/16" anywhere in an area of a 6" diameter circle.

The U-2 Head has two to twelve spindles, each built to drill up to ¾" diameter hole in cast iron. Standard spindles are furnished with No. 1 or 2 Morse Taper.

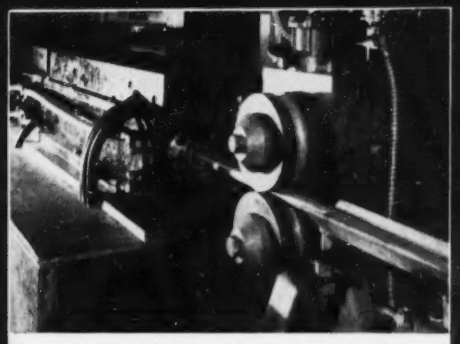
Write for details on any type of universal joint adjustable head. Ask also about our totally enclosed gear driven adjustable, fixed center, or individual lead screw tapping heads.

US HEADS SINCE 1915

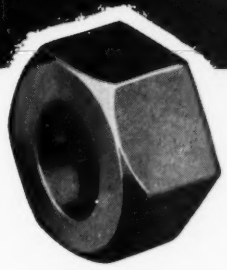
UNITED STATES DRILL HEAD CO.
616-618 Burns St., Cincinnati 4, Ohio

For more information on products advertised, use Inquiry Card, page 265

4200 Nut Blanks Per Hour



Feed rolls push barstock through TOCCO Induction Coils to heat stock to 2350°F for forging.



with TOCCO* Induction Heating

FASTER PRODUCTION—4200 nut blanks per hour—twice the output of a conventional hot punching machine—that's the result of Lamson & Sessions Company's new automatic production set up with TOCCO Induction Heating.

OTHER ADVANTAGES—TOCCO delivers exact temperatures (2350°F, plus or minus 25°) and delivers them so fast that scale has little time to form. Scale loss has been reduced to only about 1% for hot-rolled stock. TOCCO is clean and cool, fits right into the production line—no hauling to and from the heat-treat department—no unpleasant radiant heat to annoy workers.

HERE'S HOW IT WORKS—Steel bars up to 1½" diameter are fed through TOCCO Induction Coils. The first two coils, operating off a 300 kw, three kc TOCCO motor-generator set, preheat the rod. The third coil which operates from a TOCCO 250 kw 10 kc generator then boosts the rod to forging temperature. The hot rod then is fed to the special hot nut former (designed and built by NATIONAL MACHINERY CO.) which shears the rod to suitable lengths, forms the part and spits out the nut blank—ready for tapping.

In your search to find sound methods of increasing production, improving products and lowering costs, don't overlook TOCCO Induction Heating. If your products require heat treating, soldering, brazing or forging, it will pay you to investigate TOCCO for better, faster ways of producing them at lower unit costs.

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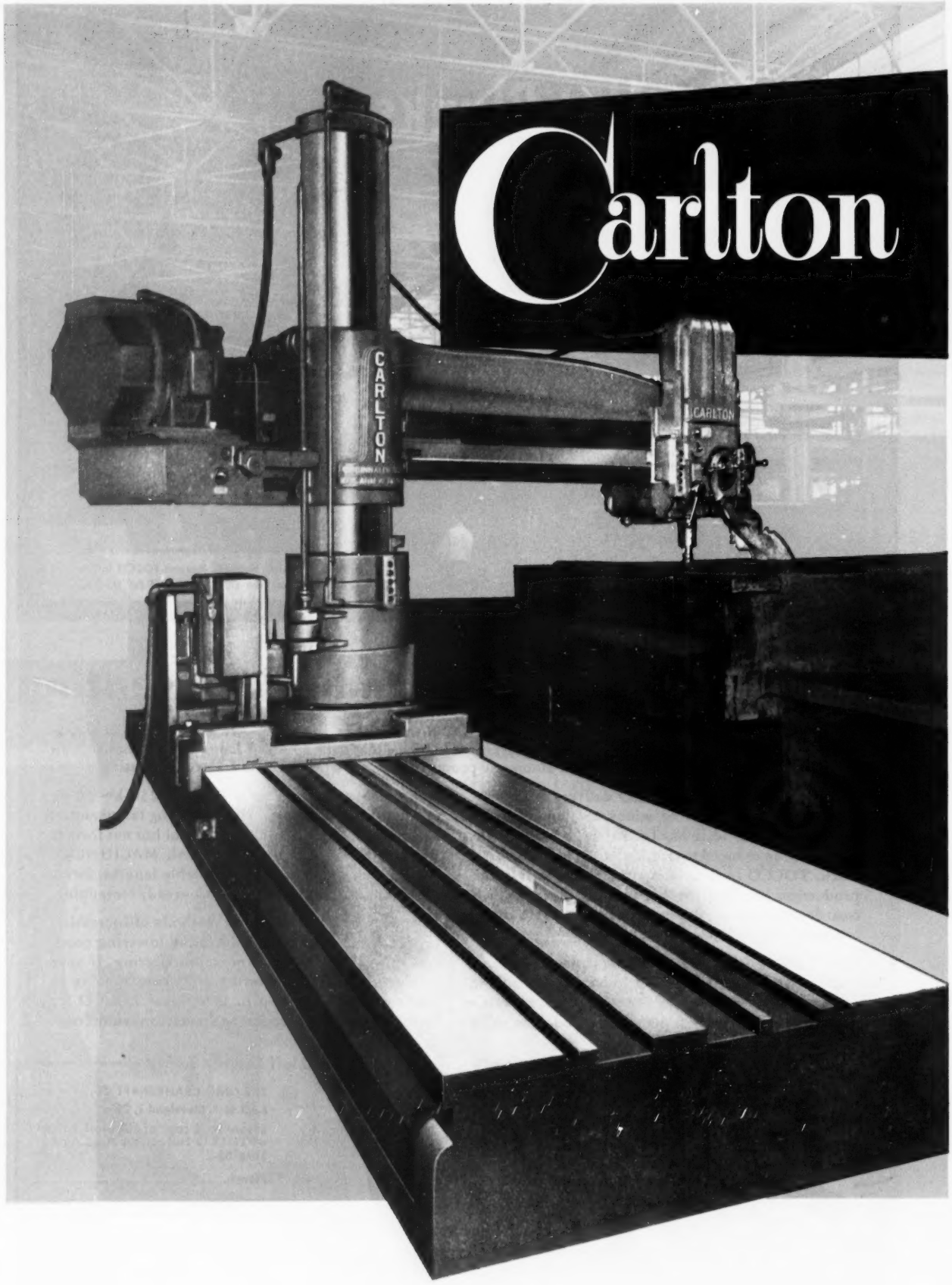

Carlton
CARLTON
CARLTON

puts you on the track to real hole drilling efficiency!

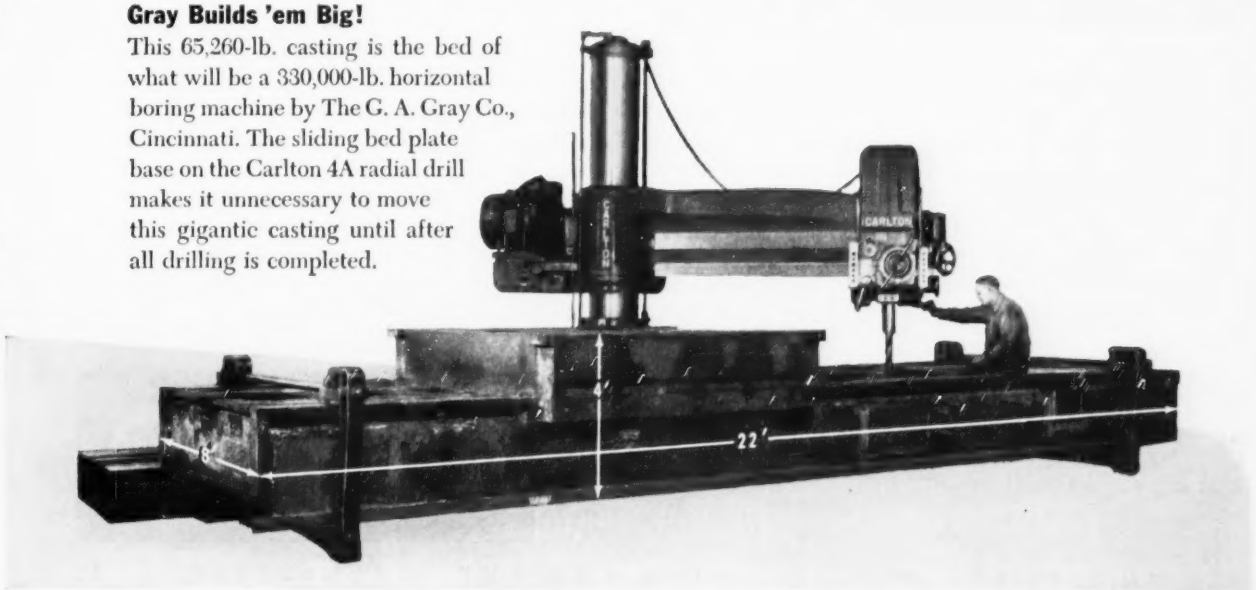
Carlton "gets around." Yes, thanks to its special sliding bed plate base, this Carlton 4A radial drill moves the entire length of this 22-ft long G. A. Gray Co. casting. At one setting it drills the required 75 levelling screw holes without the necessity of lifting so much as an ounce of its 33 tons.

Think what this special Carlton mounting saves in terms of time, energy and expense in drilling this one casting alone! And yet this is but one of many Carlton engineering achievements planned for you . . . to bring you maximum hole drilling efficiency.

Carlton offers seven other types of mountings, plus a variety of plain or uni-tilt tables and revolving jigs. And there's an equally wide choice in the Carlton radial drills themselves, too: many different models with arm lengths from 3-ft to 12-ft, column diameters from 9" to 26".

Carlton engineers will be glad to work with your engineers in laying out the most efficient radial drill set-up for your requirements. For maximum hole drilling precision and production today and tomorrow, check Carlton now. The Carlton Machine Tool Co., Cincinnati 25, Ohio.

Gray Builds 'em Big!
This 65,260-lb. casting is the bed of what will be a 330,000-lb. horizontal boring machine by The G. A. Gray Co., Cincinnati. The sliding bed plate base on the Carlton 4A radial drill makes it unnecessary to move this gigantic casting until after all drilling is completed.



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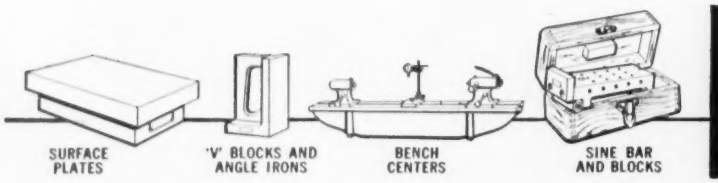
Cuts Your Set-Up Time

Here's another new Taft-Peirce shortcut to faster, easier setups for machining and inspection. The first real development in angle irons in several decades. ALL surfaces on a MULTIPLEX Angle Iron are scraped accurately flat . . . square within .0005″ in 6″ length . . . and parallel to opposite sides within .0005″ tolerance.

Note the inside right angular faces *meet*, unlike old style angle irons. Made of high quality cast iron, properly normalized and aged, base and angle sections are ribbed for rigidity. A valuable time-saver on boring mills, planers, and drill presses too, Multiplex angle irons frequently reduce multiple machining operations to only *one* setup.

Now stocked in 12″ x 12″ x 12″ size. Plain working surface (without holes or slots) measures 9″ x 12″. Approximate weight is 95 pounds. For more information on these and hundreds of other Taft-Peirce Toolroom Specialties send for your copy of the Taft-Peirce Handbook.



T-P means Top Precision

T P

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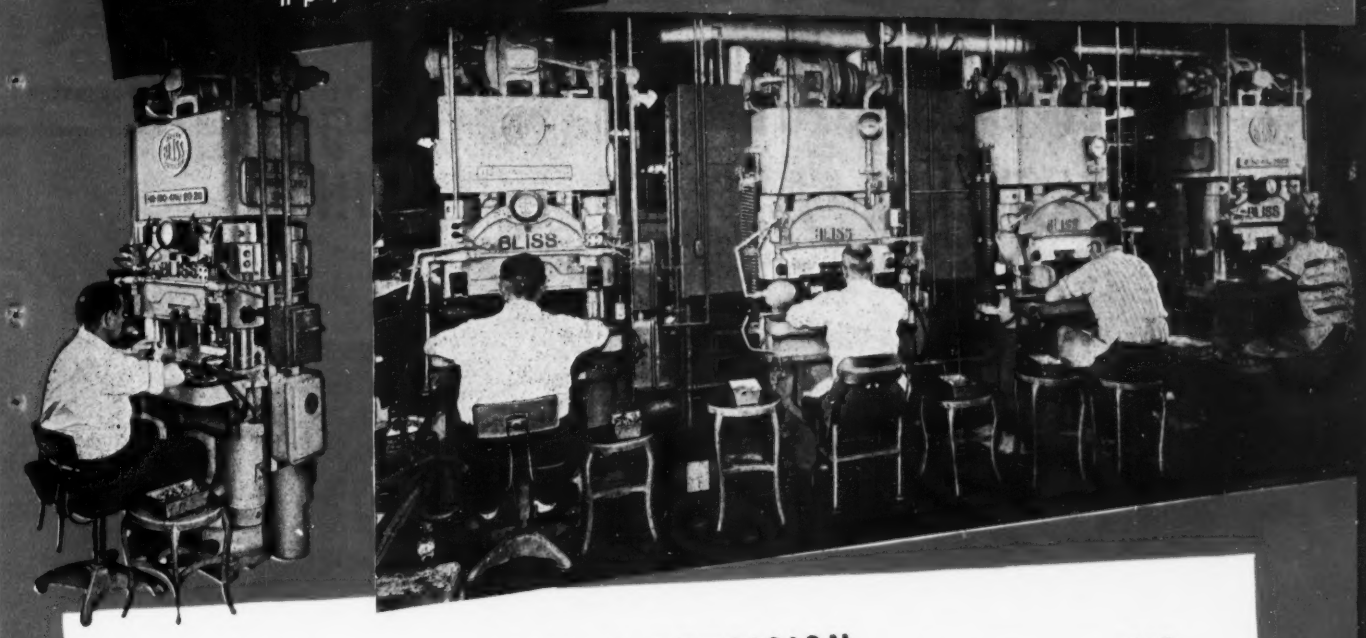
it pays to specify BLISS



Gruen obtains MICRO-PRECISION accuracy with

BLISS HYDRO-DYNAMIC PRESSES

Accuracy is the keynote of operations at the Gruen National Watch Case Company, Cincinnati, Ohio. This is especially true in the forming of the case itself. Here, tolerances are critical—with an exact fit of the crystal inside the watch case essential to keep it from falling out. Gruen prefers the Bliss Hydro-Dynamic presses for this job—holding tolerances to several ten-thousandths of an inch.

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MACHINE OF

MODEL R-18 AUTOMATIC *Lo-swing* LATHE MACHINES LARGE CYLINDER LINERS AT FAST PACE

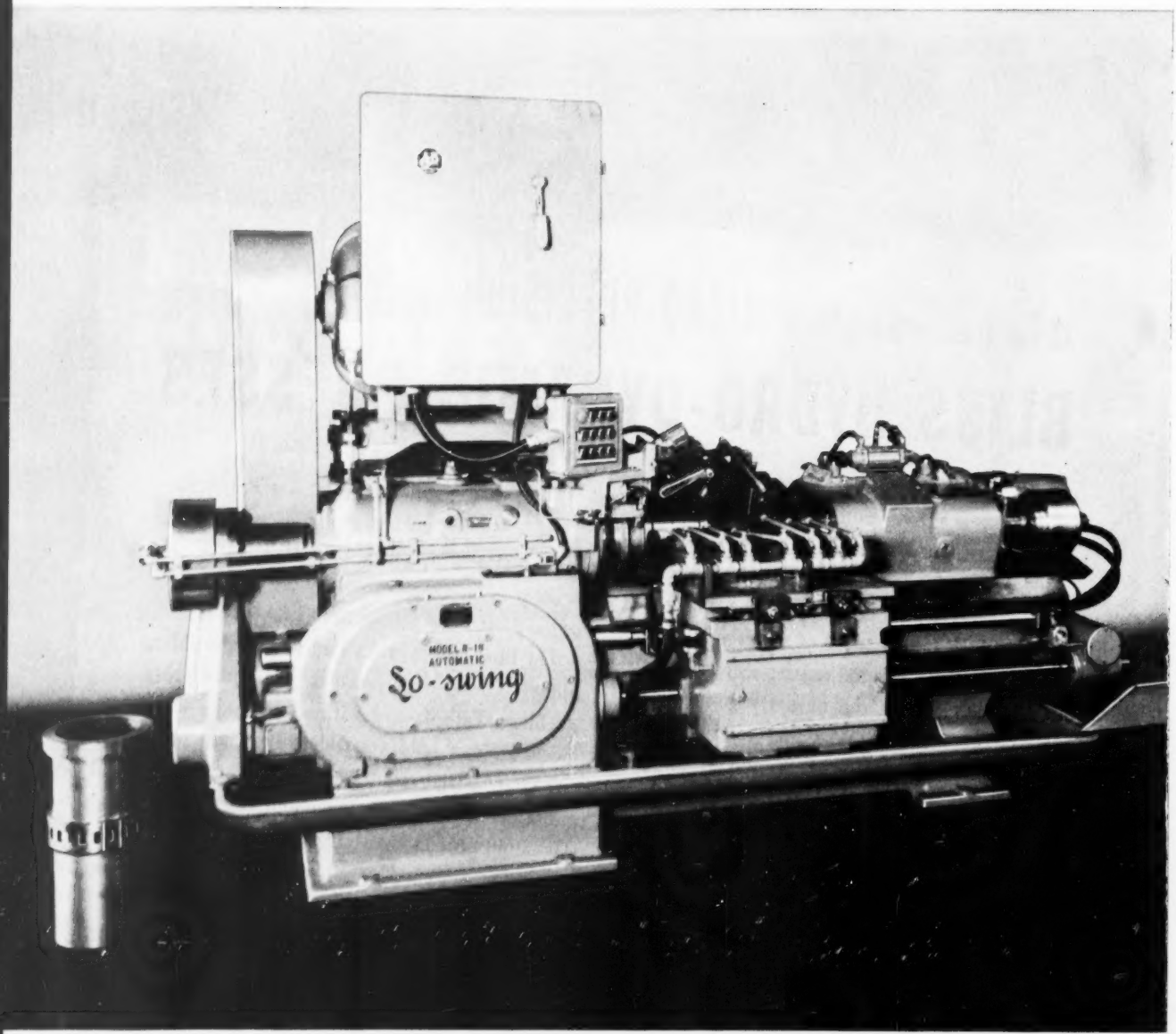


Fig. 1. *Model R-18 Lo-swing Lathe equipped for machining large cylinder liners*

PRODUCTION COSTS

THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. "THE *Lo-swing* PEOPLE" SENECA FALLS, NEW YORK

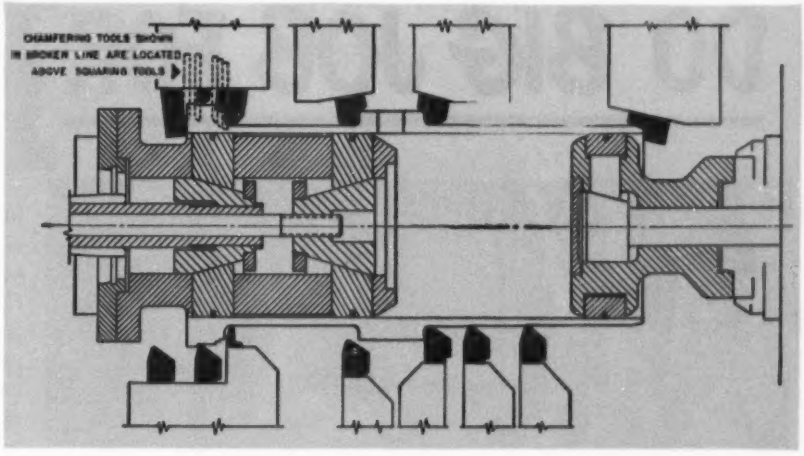


Fig. 2. *Details of arbor construction and location of 22 cutting tools*

Problem: To turn outside diameters, face shoulders and chamfer large cylinder liners 11-1/2″ diameter by 22″ long.

Solution: The large swing Model R-18 Automatic Lo-swing Lathes selected for this job were equipped with special tailstocks and tooling engineered for this particular job.

The work is held and driven by a special driver, mounted on the headstock spindle, which has two rows of six, air-operated driving jaws. Each row is operated by its individual pull bar (Fig. 2) thus equalizing the air pressure on both sets of jaws. In order to avoid distortion and provide increased support, both sets of jaws grasp the work piece where the wall thickness is greatest.

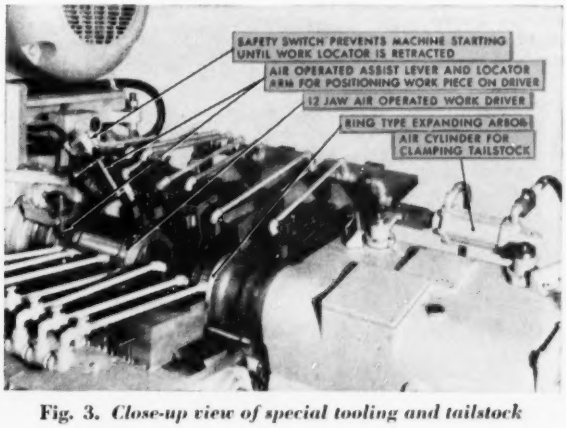

SAFETY SWITCH PREVENTS MACHINE STARTING UNTIL WORK LOCATOR IS RETRACTED
AIR OPERATED ASSIST LEVER AND LOCATOR ARM FOR POSITIONING WORK PIECE ON DRIVER
12 JAW AIR OPERATED WORK DRIVER
RING TYPE EXPANDING ARBOR
AIR CYLINDER FOR CLAMPING TAILSTOCK

Fig. 3. *Close-up view of special tooling and tailstock*

The relieving type tailstock has a 20 inch stroke, operated by a motorized lead screw, permitting easy removal of the cylinder sleeves from the long driver. Its large revolving spindle is fitted with an air-operated, ring type expanding arbor which supports the work at the tailstock end.

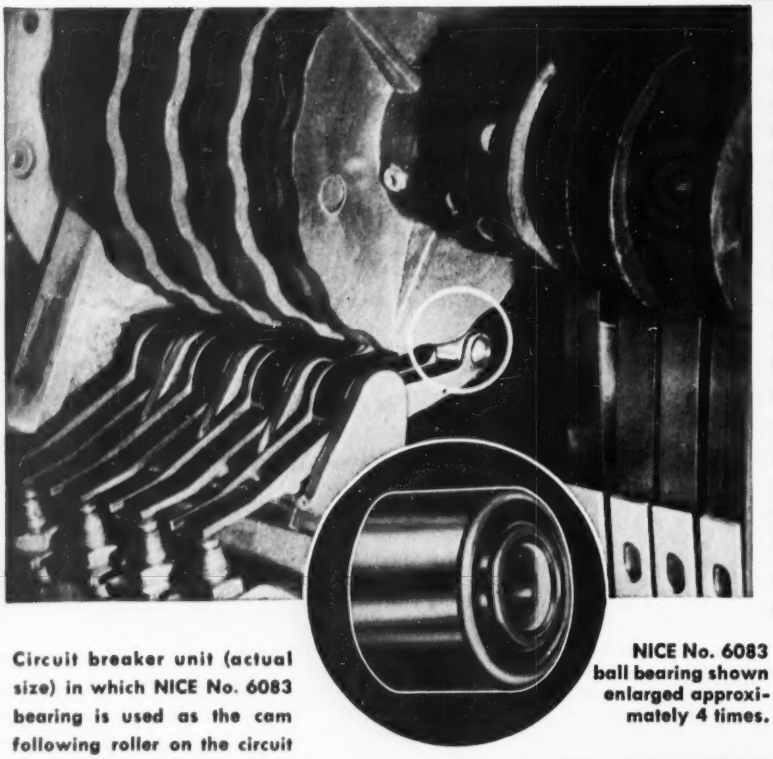
The work is located in relation to the ports previously cut around the liner body by a locator arm (Fig. 3) which enters one of the ports when swung downwards. The operator then positions the piece on the driving arbor with an air-operated assist lever which holds it tight against the locator until the driving jaws grasp it. A safety switch above the locator arm prevents the machine being started with locator in engaged position.

A 60 HP motor drives the machine. Floor to floor time is 5.2 minutes, demonstrating the substantial economies possible with Lo-swing methods. Let Seneca Falls engineers assist with your turning problems.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

ARE LOWER WITH *Lo-swing*

NICE BALL BEARINGS DO BIG JOB FOR IBM



Circuit breaker unit (actual size) in which NICE No. 6083 bearing is used as the cam following roller on the circuit breaker arm. This unit is typical of those used on IBM Accounting Machines Types 402 and 403 and on IBM Electronic Calculator Type 604. As the name implies, these circuit breakers are used to interrupt electrical circuits intermittently during operation.

NICE No. 6083 ball bearing shown enlarged approximately 4 times.

IBM equipment has gained a world-wide reputation for the speedy solution of problems in computation and the recording and tabulation of records of all kinds. NICE No. 6083 ball bearing is a small but vital part of these IBM Machines. Millions of No. 6083 have been produced to meet the ever expanding use of IBM Machines in industry, commerce and government.

This IBM use of 6083 is typical of many hundreds of similar successful NICE bearing applications, and we invite your investigation of the design and cost saving opportunities the NICE LINE can offer YOU!

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IBM Accounting Machine Type 402

IBM Electronic Calculator Type 604

NICE

NICE BALL BEARING COMPANY
NICETOWN · PHILADELPHIA · PENNSYLVANIA

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Our designers, our shop men, our management and our sales engineers *always* have this in mind . . . To everyone at "Phillie Gear", the making of good gears is a challenge . . . a "heritage" acquired from over 60 years' continuous experience.

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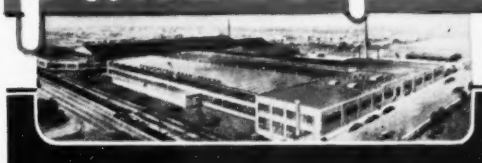

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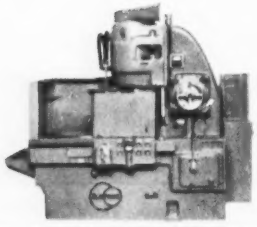
"We put the blocks, 17 per load, on a Blanchard and ground them to size . . . *in exactly the same time that my customer needed to turn 5 blocks before grinding.*

"If you could tell every machine shop owner that story, you'd sell more grinders than you could build."

We're following his suggestion!



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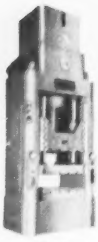
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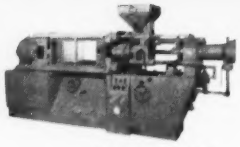
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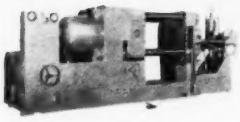
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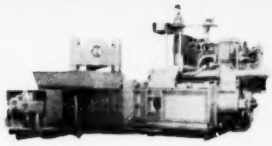
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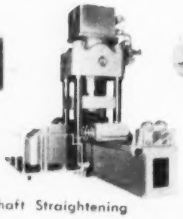
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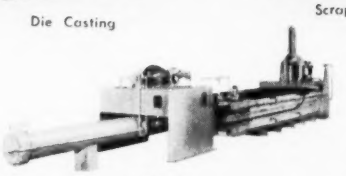
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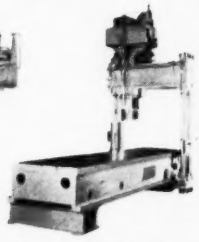
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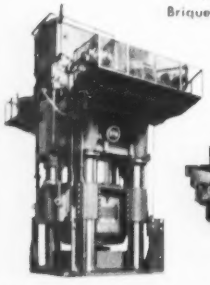
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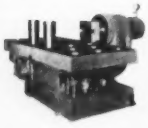
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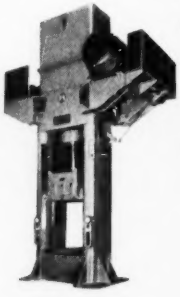
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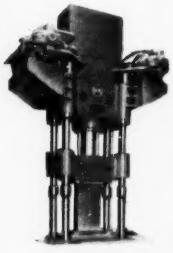
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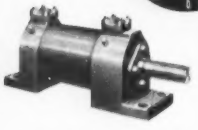
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Cockshutt Aircraft Ltd. produces improved jet engine parts at lower costs by Hydroforming

COMPLEX REENTRANT-SHAPED JET ENGINE PART is produced on the Cincinnati 26″ Hydroform in two operations. See Figs. 1 and 2 below.

Fig. 1: **1st Hydroform Operation**

Fig. 2: **2nd Hydroform Operation**

A 17⅛″ dia. blank of 0.064″ Nimonic 75 is first drawn to shape shown in Fig. 1. The punch consists of two principal elements: a segmented top and a solid base for forming the shape as shown in Fig. 2. The top, segmented section of the punch is shown at right on the table in the photograph above. Completed part and 1st operation shell are also shown. An annealing operation is used between the 1st and 2nd draws to reduce the grain size. To achieve additional clarity of outline at the neck section, the part is rolled after trimming.

A leading supplier of jet engine parts, Cockshutt Aircraft Ltd., Renfrew, Ontario, Canada, is obtaining many production economies by *Hydroforming* a variety of engine components that would be costly or difficult to produce by conventional methods. Two Cincinnati Hydroforms of 12″ and 26″ capacities are employed. The part shown in the photograph above and in Figs. 1 and 2 is typical of the work produced by Hydroforming.

Frequently Cockshutt finds it advantageous to combine Hydroforming and mechanical pressing to produce a drawn part. They report the following benefits are obtained from total Hydroforming and from combined Hydroforming-mechanical press drawing:

- Greatly reduced tool costs.
- Parts are produced free from wrinkles, deformation and excessive scratching.
- Part quality is improved as there is a minimum of wall and nose thin-out. The metal is displaced rather than stretched into shape.

Hydroforming offers many time- and cost-saving advantages—particularly for development work and for short runs. Let a Cincinnati Milling field engineer give you complete details. For a description of the Hydroforming process and specifications of the 8″, 12″, 19″, 23″, 26″ and 32″ machine sizes, write for Bulletin M-1759-3.

CINCINNATI

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO, U. S. A.

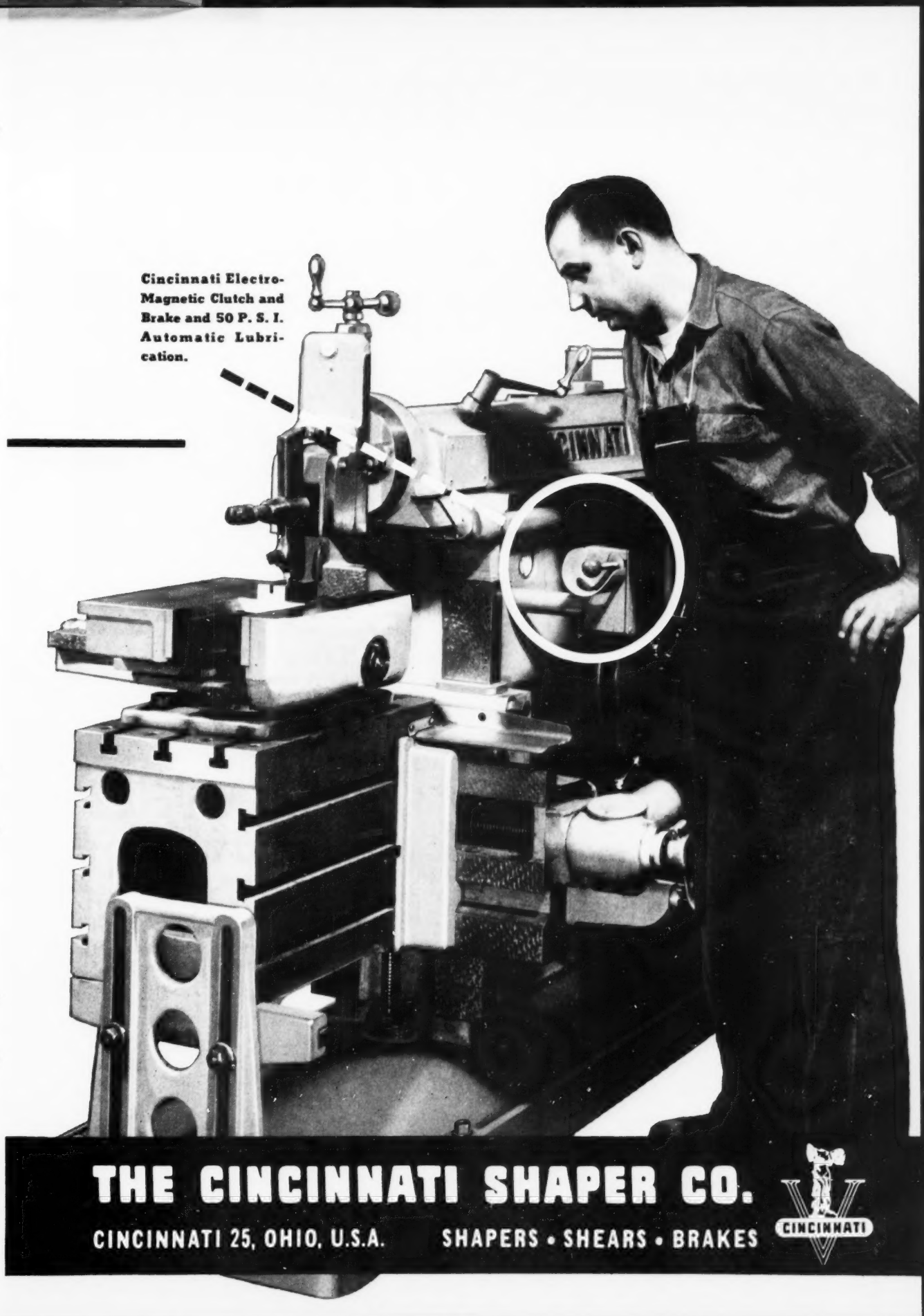
toolmakers prefer this CINCINNATI shaper

17 cubic foot Revco, one of many Food Freezer models built by Revco, Inc., Deerfield, Michigan.

Revco, Inc., producers of Food Freezers, state their toolmakers prefer using this 20" H. D. Cincinnati Shaper. They like the convenience of all controls located at the operator's position and the amazing speed of the electro-magnetic clutch and brake. They like the assurance provided by the 50 P.S.I. automatic lubrication. They like the very high accuracy obtained in shaping jigs and fixtures, drawing, forming and blanking dies.

Write for the new illustrated catalog N-6 on Cincinnati Shapers.

Photo courtesy Revco, Inc., Deerfield, Michigan



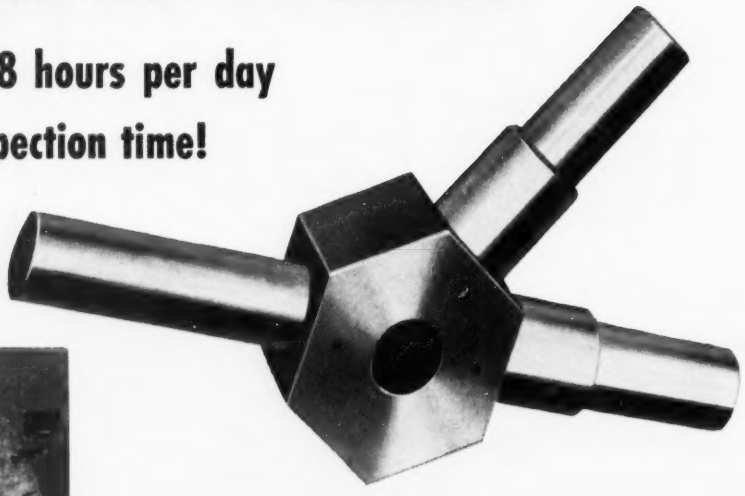
THE CINCINNATI SHAPER CO.

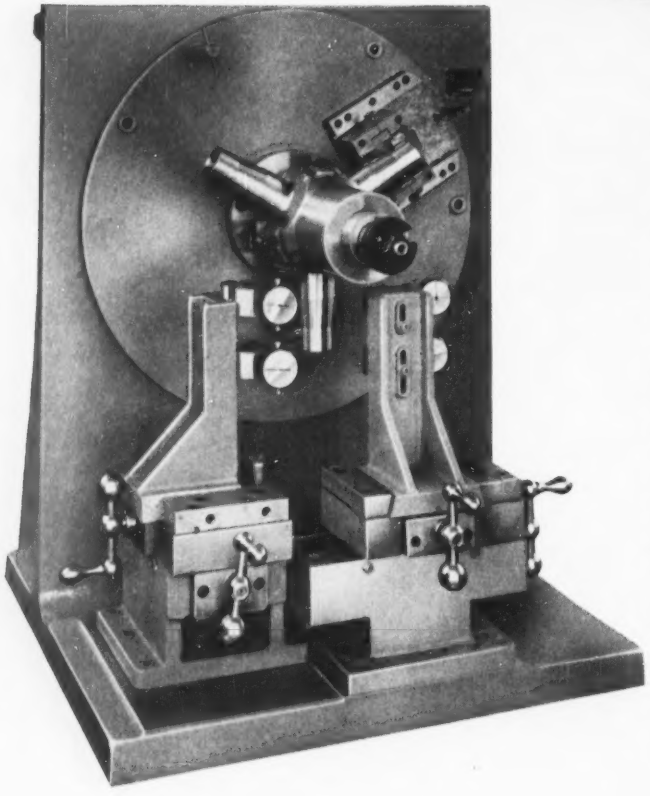
CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

CINCINNATI

The Checking Fixture No One Wanted To Make

. . . is now saving 8 hours per day in precision inspection time!





The extremely close fit of the adapter, required to make it a universal tool, discouraged leading gage manufacturers throughout the country from attempting its manufacture, but the gage was built, both within tolerance and on schedule, by Turner Bros. skilled craftsmen.

Designed by a leading aircraft manufacturer to eliminate inspection bottlenecks, it checks a number of different parts to a tolerance of one ten thousandth in 6" for angularity, runout, parallelism and location at room temperature.

To further illustrate the almost impossible tolerances demanded in its manufacture: (1) The checking points on the master run within one ten thousandth at the end of the shaft 20" long swinging on a 22" circle. (2) The unfavorable aspect ratio could have caused an error of seven times original tolerance. This forced Turner craftsmen to work within millionths rather than the one ten thousandth print tolerance.

Perhaps you too have an "impossible" inspection problem, and perhaps Turner can be of assistance in helping you design and build a checking fixture to do the job. Why not write us today describing your problem, and after our engineering department analyzes it, our field engineer will discuss it with you.

Got a Tough Production Problem?

Turner has been helping both large and small manufacturers solve tough production problems by designing and building special purpose machines. All of these machines use standard bases and columns to keep manufacturing costs down. It means you are assured of a machine specially designed for your particular application, yet without the high extra costs you might expect. Write today describing your problem. After our engineering department analyzes it, our field engineer will discuss it with you.

TURNER BROS. INC.
2625 HILTON ROAD
FERNDALE 20, MICHIGAN
DESIGNERS and BUILDERS of:
• SPECIAL MACHINES
• JIGS and FIXTURES

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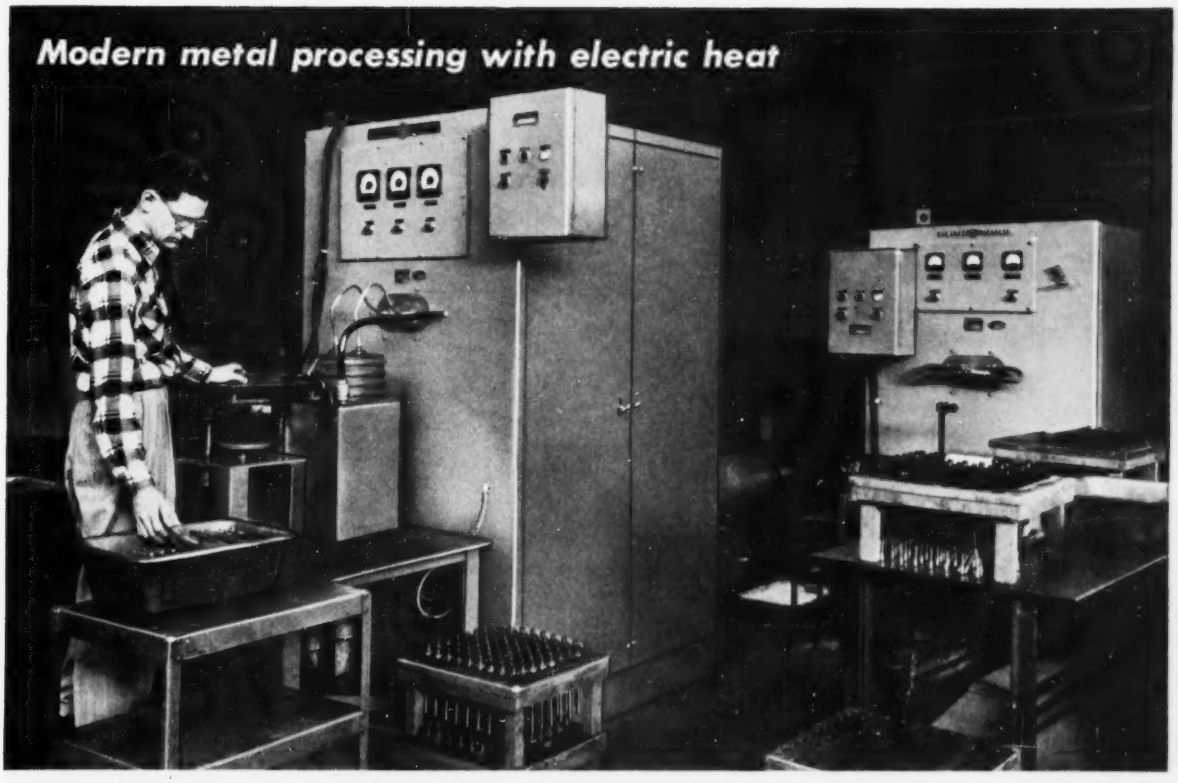


BUFFALO ARMS HAS BEEN USING G.E.'S 20-KW AND 5-KW INDUCTION HEATERS FOR 2½ YEARS WITHOUT A MAJOR BREAKDOWN.

Says Buffalo Arms:

"G-E induction heaters insure quality guns that meet rigid government requirements"

General Electric induction heaters perform dependably whether they are used for hardening, brazing, annealing, or soldering, reports Buffalo Arms, Inc., Akron, N. Y. ordnance equipment manufacturer.

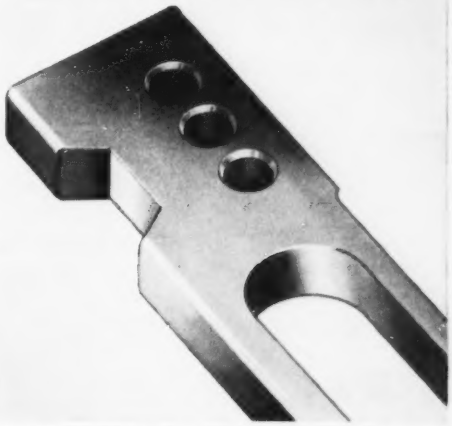
Says W. I. Wood, Chief Methods Engineer: "The aircraft guns we produce have many working parts that require special heat treating and hardening to insure their dependable performance. Our G-E induction heaters give us that degree of accuracy and uniformity needed to meet rigid government standards and assure top quality in our finished product."

FOR APPLICATION ASSISTANCE

To learn how you can profitably apply induction heat in your metal processing, contact your nearest G-E Apparatus Sales representative. And write for the new, modern-metal-processing bulletin, GEA-5889, on furnace and induction brazing. Address: General Electric Company, Section 720-133, Schenectady 5, N. Y.

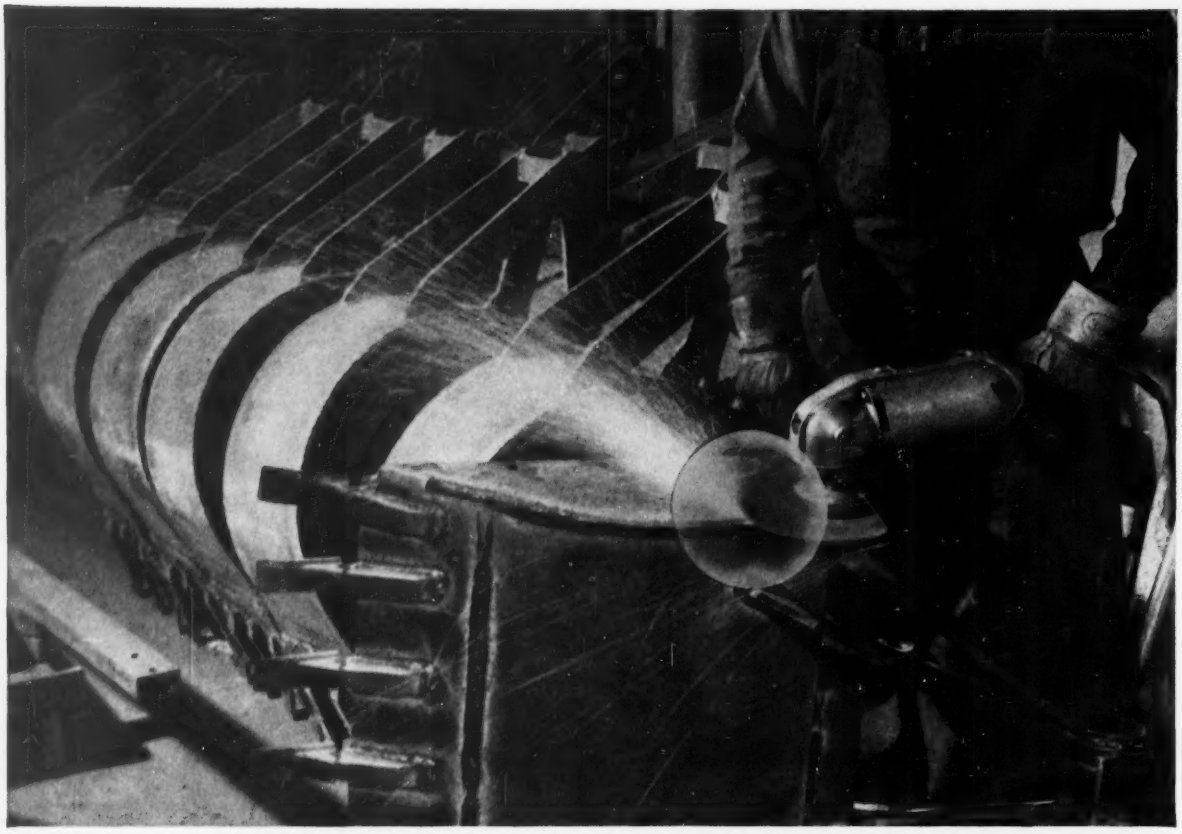
GENERAL ELECTRIC

G-E INDUCTION HARDENING



SELECTIVE HARDENING of this breech-block slide is a typical operation at Buffalo Arms.

For more information on products advertised, use Inquiry Card, page 265



The BD is the preferred hub-type wheel for heavier stock removal. Ideal for smoothing and blending welds on fabricated work; smoothing flame-cut edges and stainless steel welds; cleaning between teeth of gear castings; many slotting, notching and cutting-off operations.

4 Great Team-Mates for your "TOUCH of GOLD"

Norton REINFORCED WHEELS add value, cut costs, on hundreds of grinding jobs

Here's The Line-Up

BD Rigid hub-type, resinoid bonded. Glass cloth reinforcement for high strength plus the Nylon layer add up to extra hub-wheel safety. For the more severe jobs on your right angle grinders.

BFR Semi-flexible hub-type, resinoid bonded. Cotton fabric reinforcement with the additional layer of Nylon. For better finish and contour blending.

BF Semi-flexible straight wheel, resinoid bonded. Cotton fabric construction similar to the BFR but without Nylon reinforcement. For periphery grinding only. An excellent deburring and finishing wheel. Also available in mounted wheels and points and in hand sticks.

BN Straight wheel, resinoid bonded. Glass cloth reinforcement, as in the BD. Provides very high resistance to breakage in a wide range of cutting-off and other jobs.

Add outstanding versatility to strength and to safety, multiply the result by four and you have one reason why this Norton team rates as the "Big 4" among reinforced wheels.

Separately, each handles a considerable number of important grinding jobs. Together, they cover an almost endless list of applications, ranging from light deburring to severe cutting-off. And they do every one of these jobs with the *extra* safety, service life and economy that add the real "Touch of Gold" to your grinding operations.

Your Norton Distributor

will be glad to demonstrate Norton Reinforced Wheels in your shop, and to aid you in any grinding problem. Or write to NORTON COMPANY, Worcester 6, Mass. for the Brand New Catalog on Reinforced Wheels. Distributors in all principal cities, listed under "Grinding Wheels" in your classified phone directory. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Massachusetts. W-1551

NORTON
ABRASIVES

Making better products... to make other products better

The BFR is outstanding for light snagging, light weld grinding, smooth finishing, blending contours and corners, removing mold marks, removing rust and scale; and scarfing and beveling before welding. Also for notching gates and risers.

The BF, a straight wheel version of the BFR, is the wheel to use for light deburring, breaking edges on machined work, taking off flash from plastic parts, removing light welds and many other miscellaneous light portable and bench grinding applications.

The BN is the recommended cut-off wheel wherever great strength and safety are vital. Excels at cutting-off non-ferrous gates and risers and various non-metals. Its range also includes cutting wire rope, slotting rails, tuck pointing, etc. Small sizes are popular on small portable grinders.

BF Mounted Wheels and Points, like all Norton mounted wheels and points, are trued on their own spindles. Having the same laminated construction as the larger BF wheels, they are designed for such jobs as finishing plastic molds, glass molds, forging dies, etc. For hand finishing, use BF sticks.

This little red wagon presented a big drawing problem!

A Standard engineer's advice helped cut rejects by over 90%

● In the manufacture of children's wagons at the Steger Products Manufacturing Company in Steger, Illinois, 20-gauge cold rolled steel is drawn to a 4½" depth. Of the 8-hour shift capacity of 1600 to 1800 wagon bodies, up to 20% formerly wound up as rejects. Also, it was necessary to clean the dies after every 10 to 15 bodies. A single small scratch on the die caused excessive die galling and torn or ruined bodies.

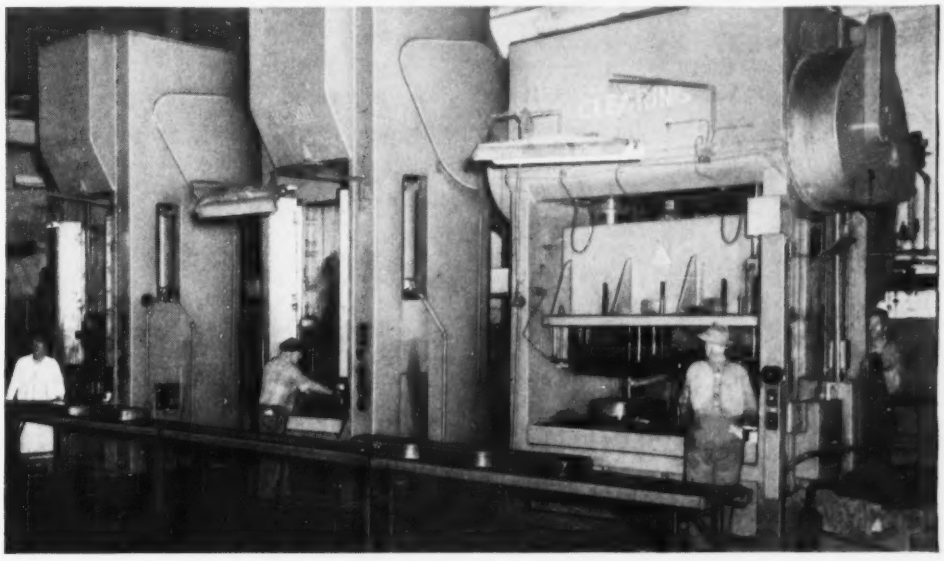
The company tried 10 or more drawing compounds without solving the problem. Then a Standard Cutting Oil Engineer suggested STANICOOL HD Soluble Oil.

That was six years ago and STANICOOL HD is still on the job. The reject rate has been reduced to less than 1% a day. Die galling has come down to almost nothing. Dies are now cleaned only once or twice daily. Again, Standard Oil's metalworking products prove they can do the hard jobs better!

STANICOOL HD Soluble Oil: for cutting and grinding operations, for certain forming operations. Mixes readily, non-irritating, anti-rust. To take full advantage of this many-purpose cutting fluid, call on the services of your Standard Oil Cutting Oil Engineer. If your plant is located in the Midwest, write Standard Oil Company (Indiana), 910 S. Michigan Avenue, Chicago 80, Illinois, to secure the services of the Standard Cutting Oil Engineer nearest you.

Standard's Bill Easterwood worked with the Steger Company on their drawing problem. Specially trained, Bill Easterwood is one of a corps of cutting oil and lubrication engineers headquartered near your plant throughout the Midwest. There's a specialist to assist you with *your* lubrication problem.

At Steger, die cleaning is of major importance because a single scratch can result in torn or ruined bodies during the processing. Since the introduction of STANICOOL HD, the time-consuming die-cleaning operation has been safely reduced to an *effective* minimum.



In this deep-draw operation STANICOOL HD is used just as it comes from the barrel without the addition of water. The 22-gauge cold rolled steel is drawn to a depth of 4½". The sheets are dabbed with STANICOOL HD as they are put on the press. Breakage which formerly had been a major problem has been reduced to a point where it is no problem at all.

STANDARD

STANDARD OIL COMPANY *(Indiana)*

A complete line of metalworking products including: STANICUT Cutting Oils—Special duty cutting oils with correct proportions of extreme-pressure and friction-reducing ingredients. STANOSTAMP Compounds—Three established products for stamping or heavy drawing operations on either low-carbon or alloy steels. SUPERLA Quenching Oil—For quenching work on systems where cooling facilities are limited and bath temperatures are high; efficient quenchings of large forgings.

Here's another reason it pays to get a proposal from Fosdick

"Lathe Bed Production Time Slashed 6 hrs."

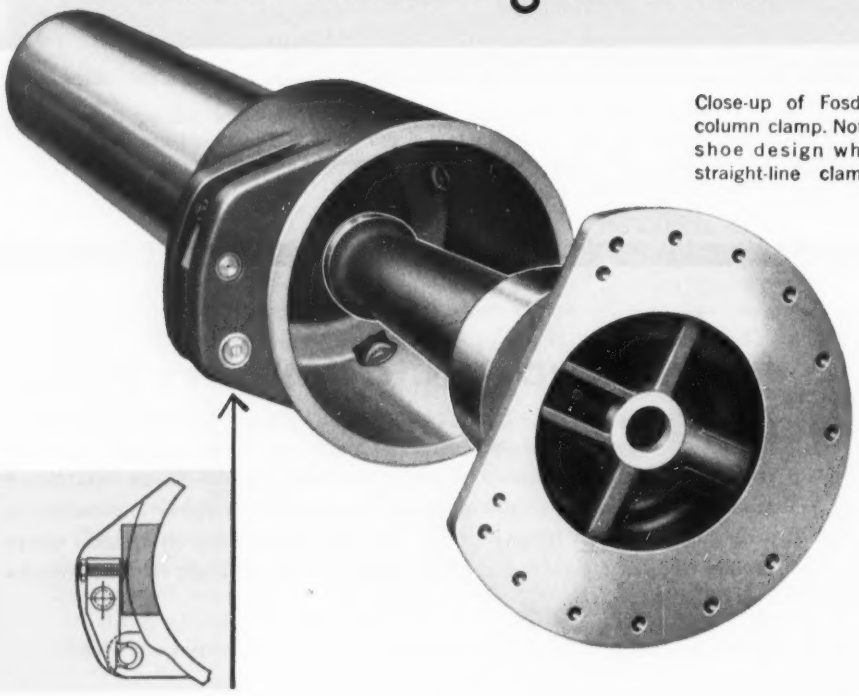
"Since installing our new FOSDICK"...

says Sidney Machine Tool Co.

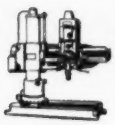
"Our new Fosdick Radial is easy to handle, requires less time for job set-ups. And its operating advantages are numerous. Formerly, we put 28 hrs. into drilling our 28' lathe bed. But with our new Fosdick Radial Drill, we've cut drilling time by 6 hours . . . saved valuable production time! We've found that it pays to get a proposal from Fosdick."

Fosdick Hydraulic Radials are available with 3' to 8' arms, 11" to 19" columns. For full information, ask for Bulletin AT-M.

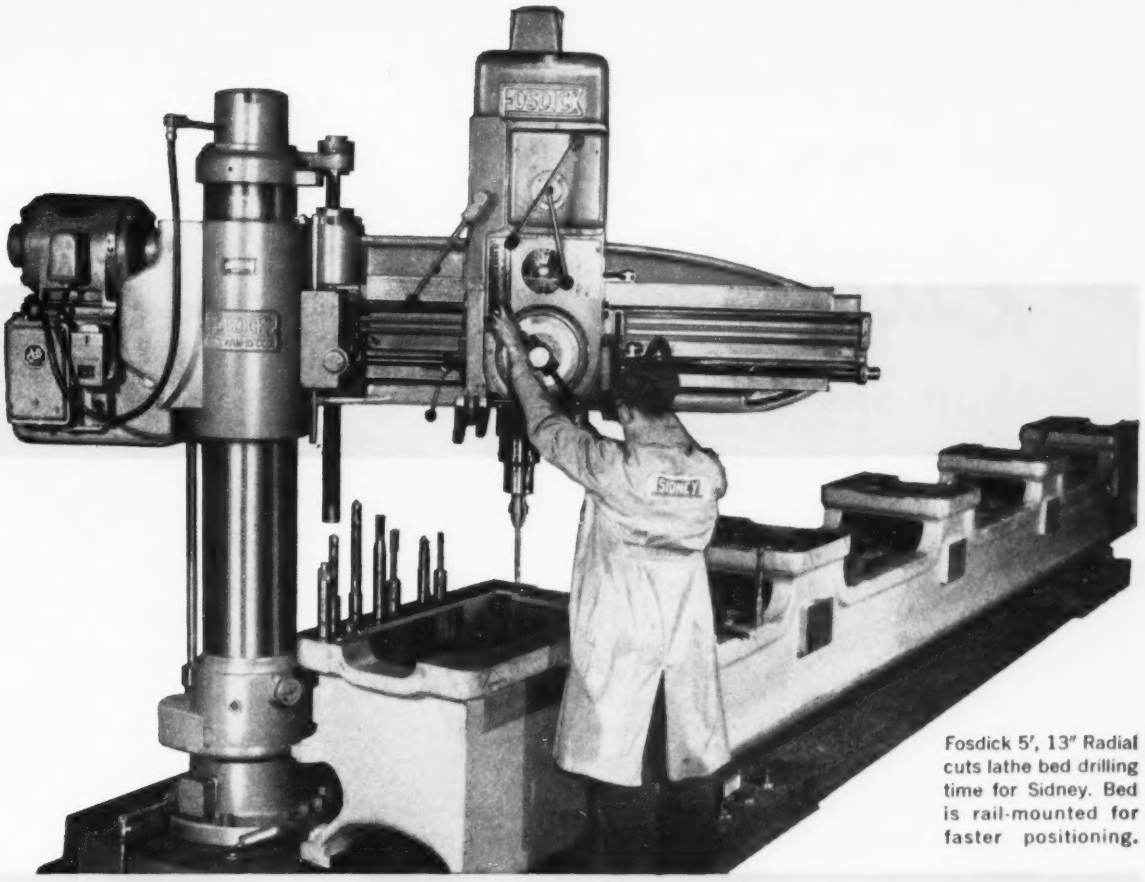
Fosdick Radials give Faster Drilling...



Close-up of Fosdick hydraulic column clamp. Note the sliding-shoe design which gives it straight-line clamping action.



Radial Drills



Fosdick 5′, 13″ Radial cuts lathe bed drilling time for Sidney. Bed is rail-mounted for faster positioning.

More Rigidity . . . Easier Handling.

Fosdick Radials give you many features that insure fast, rigid, precision drilling. To name a few:

Hydraulic Column Clamp. New sliding-shoe design gives rigid straight-line clamping action. Prevents side movement of column for sustained accuracy and speed of drilling.

Locking Control. With this feature, set-up time is reduced to a minimum. When feed mechanism is engaged, an automatic interlock clamps the head and the column. When feed is disengaged, clamping is maintained. This permits the operator to change tools without disturbing the position of the head. Clamping is disengaged by independent levers.

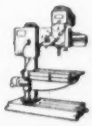
Tool Ejector. For speedy tool removal all the operator has to do is to move the spindle to its extreme upper position. This automatically disengages the tool. No drifts or hammers necessary.

Automatic Positioning Table. Now, available for use with radial drills! Without jigs, the Fosdick Automatic Positioner makes possible exact reproduction of precision drilled, bored, tapped and reamed parts . . . within tenths! For details write for Bulletin AT-M.

Need Drilling Equipment? Get a Proposal from Fosdick!

Jig Borers

Sensitive and Upright Drills


Sensitive Radial Drills

Automatic Positioning Machines

THE FOSDICK MACHINE TOOL CO., CINCINNATI 23, OHIO

FOSDICK

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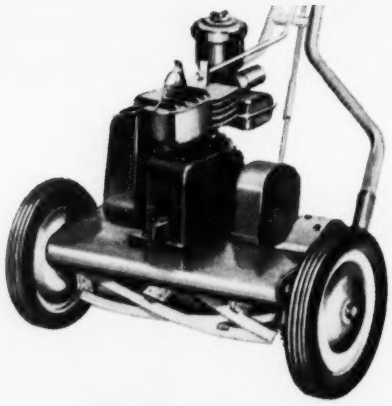
Why more manufacturers of POWER LAWN MOWERS use KLOZURES* than any other oil seal!



1. **They're uniform**—both in sealing contact and in spring load. KLOZURES are precision made to the highest standards of accuracy.

2. **They save space**—these seals are compact and light in weight, yet they're rugged.

3. **They give positive bearing protection**—KLOZURES seal the lubricant in *and* keep dust, dirt and water out.

4. **They save money**—made in radial widths smaller than conventional oil seals and with fewer parts.

Model 93-B—A narrow cross-section seal with synthetic rubber outer covering for soft metal housings.

Model 71A—A narrow cross-section springless seal for grease retention and dirt exclusion.

Model 71-B—A narrow cross-section spring-loaded seal for either light or heavy lubricants.

Leading manufacturers of power lawn mowers and power lawn mower engines know they can depend on Garlock KLOZURE oil seals for maximum bearing protection under rugged service conditions. Engine manufacturers use KLOZURES on the output shaft. Power lawn mower makers use Garlock KLOZURES to protect bearings on wheels, reels and gear boxes.

Let us show you how Garlock KLOZURE oil seals can prolong the life of your bearings. There's a service-tested KLOZURE model for every bearing application. Get all the facts—call your GARLOCK representative or write for KLOZURE Catalog No. 10.

THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK

Sales Offices and Warehouses: Baltimore • Birmingham • Boston • Buffalo • Chicago • Cincinnati • Cleveland • Denver Detroit • Houston • Los Angeles • New Orleans • New York City • Palmyra (N. Y.) • Philadelphia • Pittsburgh • Portland (Ore.) • Salt Lake City • San Francisco • St. Louis • Seattle • Spokane • Tulsa.

In Canada: The Garlock Packing Company of Canada Ltd., Toronto, Ont.

*Registered Trademark

GARLOCK

PACKINGS, GASKETS, OIL SEALS
MECHANICAL SEALS
RUBBER EXPANSION JOINTS

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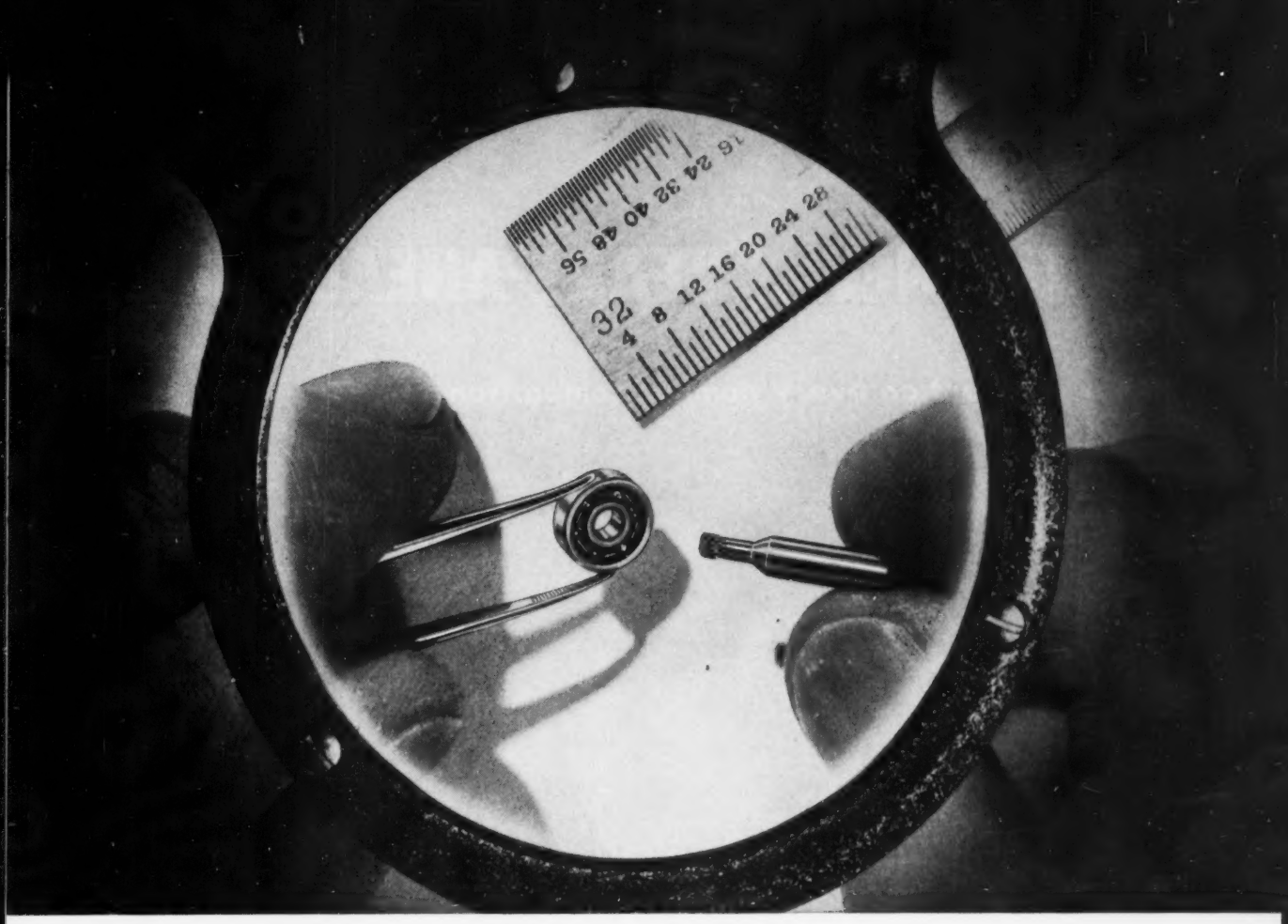


For Finishing Small Holes

(Down to .032" dia.)

ECONOMICALLY . . .
OVER 2,000 PIECES PER BUR

RAPIDLY . . .
AS LITTLE AS 30 SECONDS PER PIECE

ACCURATELY . . .
TO .0002" FOR SIZE AND 50 MILLIONTHS FOR ROUNDNESS

You can't beat a KELLERFLEX CARBIDE HOLE FINISHING BUR

Small hole finishing with Pratt & Whitney KELLERFLEX Burs is superior to all other methods. In actual production, a single bur has finished as many as 3,000 holes in hardened steel bearing races . . . compared to only 7 for mounted points. Only Kellerflex Carbide Hole Finishing Burs, engineered and master machine ground for precision and concentricity, can deliver this cost-cutting performance.

PRATT & WHITNEY
DIVISION NILES-BEMENT-POND COMPANY
WEST HARTFORD 1, CONNECTICUT, U. S. A.
SINCE 1860

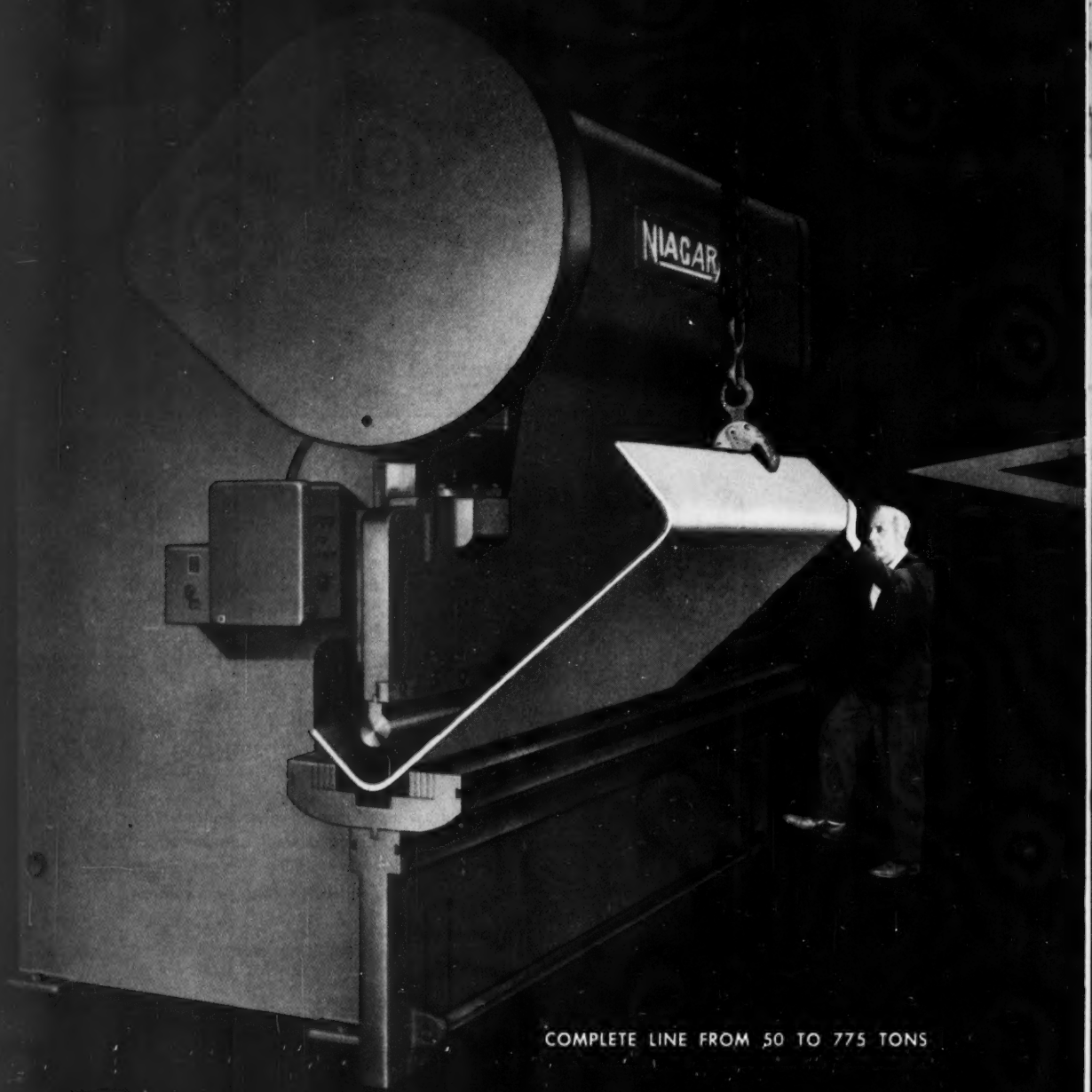
First Choice for Accuracy

BRANCH OFFICES . . . BIRMINGHAM • BOSTON • CHICAGO • CINCINNATI • CLEVELAND • DALLAS (The Stanco Co.) • DETROIT • HOUSTON (The Stanco Co.) • LOS ANGELES • NEW YORK • PHILADELPHIA • PITTSBURGH • ROCHESTER • SAN FRANCISCO • ST. LOUIS • EXPORT DEPT., WEST HARTFORD

MACHINE TOOLS • CUTTING TOOLS • GAGES

IT'S THE NEW, "YEARS-AHEAD" LINE ...

Far out front on every point of comparison



COMPLETE LINE FROM 50 TO 775 TONS

NIAGARA MACHINE & TOOL WORKS 1879 75 1954

America's Most Complete Line of Presses, Shears, Machines and Tools for Plate and Sheet Metal Work

NIAGARA

ALL STEEL PRESS BRAKES

"MULTI-MACHINE" VERSATILITY TO BOOST PRODUCTION

Practically limitless in their scope of forming, bending, punching, blanking and related operations, Niagara Press Brakes get more done for you because they do more jobs. One reason: Advanced design. Another: The extensive line of Niagara Press Brake Dies available.

UNIFORM BENDS WITH STRAIGHT-EDGE ACCURACY

Double end twin drives with double reduction gearing, *on all models,* provide uniform, constant application of power at both ends of the ram. Off-center loading presents no problem.

Rugged, streamlined frames feature box type crowns of unequaled strength and rigidity, assuring maximum resistance to deflection and permanent alignment of bearings and ram.

3-SHIFT STAMINA TO HANDLE WORK-HEAVY SCHEDULES

Close attention has been given to every design detail. Nothing has been overlooked. Each frame size has been scientifically tested to detect and eliminate harmful stresses at all critical points.

Laminated non-metallic ways, an exclusive Niagara feature, reduce wear to an absolute minimum, providing accurate alignment and longest possible service life. All gearing is totally enclosed in sealed oil baths for thorough, clean lubrication.

Once again, Niagara's forward-thinking engineering has produced a metal working machine years ahead of its time. As you become familiar with the significant developments embodied in this revolutionary new line of all steel press brakes, you will realize why it carries the Niagara nameplate. After all, who is more uniquely qualified to be its builder than the builder of America's most famed and most complete line of presses, shears, other machines and tools for plate and sheet metal work?

Call in your nearest Niagara representative at once. Let him tell you, *in detail,* what these great, new press brakes can do for you.

CHECK ALL THE FACTS, YOURSELF!

Compare. Make a careful, feature-by-feature appraisal of Niagara's years-ahead press brake design. Write for new Bulletin 89C . . . the most comprehensive press brake literature ever published.

NIAGARA MACHINE & TOOL WORKS
BUFFALO 11, N. Y.
DISTRICT OFFICES:
Detroit • Cleveland • New York • Philadelphia
Dealers in principal U. S. cities and major foreign countries

engineered to expand your output ...AT SAVINGS!

✓ **OFF SHELF DELIVERY!**

✓ **EXTRA HIGH SAFETY FACTOR!**

✓ **DEPENDABILITY . . . backed by 38 Years of Know-How!**

CIRCULAR HEADS WITH TIE RODS
SQUARE HEADS WITH TIE RODS
T-J
T-J
T-J
SPACE SAVED
T-J SPACEMAKER . . . provides additional room for adjacent equipment without sacrificing strength.

NEW (T-J)

Spacemaker AIR CYLINDERS

Streamlined design of the new T-J Spacemaker *eliminates tie rods . . . saves up to 40 % in mounting space!* It's performance-proved . . . *super rugged* with extra high safety factor . . . solid steel heads . . . heavy wall, precision honed, *hard chrome plated,* seamless steel body . . . leakproof cylinder head to body construction . . . heavy duty, hi-tensile, *hard chrome plated* piston rod.

Available with the new T-J Super Cushion Flexible Seals which insure positive cushion with automatic valve action for fast return stroke. Many standard sizes and styles . . . for pushing, pulling, lifting, clamping or control jobs. T-J dependability. Write for bulletin 454. The Tomkins-Johnson Co., Jackson, Mich.

(T-J) **TOMKINS-JOHNSON**

RIVITORS · AIR AND HYDRAULIC CYLINDERS · CUTTERS · CLINCHORS

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CLE◇FORGE *High Speed* DRILLS

Give More Holes Per Grind

On every job – no matter how difficult it may be – you'll appreciate the *extra* quality in these famous drills. They produce better work faster, at lower cost. No other drill gives you such outstanding *performance* and *economy*.

THE **CLEVELAND** TWIST DRILL CO.

1242 East 49th Street • Cleveland 14, Ohio

Stockrooms: New York 7 • Detroit 2 • Chicago 6 • Dallas 2 • San Francisco 5 • Los Angeles 58

E. P. Barrus, Ltd., London W. 3, England

TELEPHONE YOUR INDUSTRIAL SUPPLY DISTRIBUTOR

NEW!

PARALLOC
Dial Snap Gages
"D" (Direct) TYPE

Introducing a new type of pin locking mechanism which maintains constant parallelism between anvil faces.

8 SIZES, each with 1" range, cover over-all range 0" to 8"

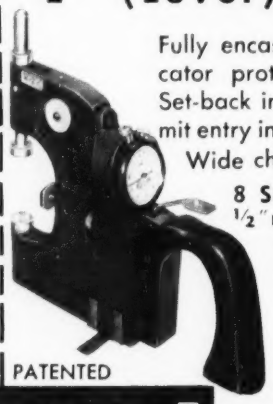
PATENTED

NEW!

PARALLOC
Dial Snap Gages
"L" (Lever) TYPE

Fully encased movement and indicator protected against damage. Set-back indicator and handle permit entry into narrow recesses. Wide choice of indicators.

8 SIZES, each with ½" range, cover over-all range 0" to 4"



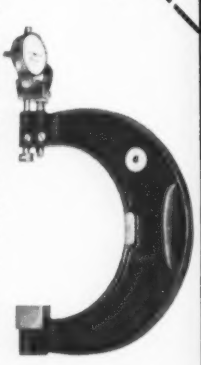
PATENTED

NEW!

NEWS!
STANDARD GAGE presents a number of NEW PRODUCTS
each deliberately designed to help you do a better job

Dializers®

STANDARD's original device for converting AGD Adjustable Limit Snap Gages to *DIAL* Snap Gages now available with wide range of indicators from 1⅛" to 2¼" diameter, graduations of .001", .0001", .0005" and .00025", and a wide variety of dial markings, including metric.



Available separately for your frames or assembled in AGD frames supplied by us.

PATENTED

Dial Bore Gages

Three new models extend dial bore gaging range by intermediate steps down to ⅛" diameter. Each utilizes STANDARD's new, highly practical CENTERING-SIZE DISC principle. Simple in design, easy to set, easy to use, but amazingly accurate and effective in small bore gaging.

STANDARD Dial Bore Gages now available in 10 sizes covering range from ⅛" to 24"

PATENT APPL. FOR

NEW!

PARALLOC DUAL THROAT Midget Dial Comparator

A most useful and versatile gaging instrument. Upper throat is deep, for measuring flat work pieces and stock. Lower throat designed for gaging small round or cylindrical pieces. Three-eighth inch range. May be used as dial comparator at inspection bench, or gage may be detached and brought to work piece like a dial snap gage.

PATENT APPL. FOR

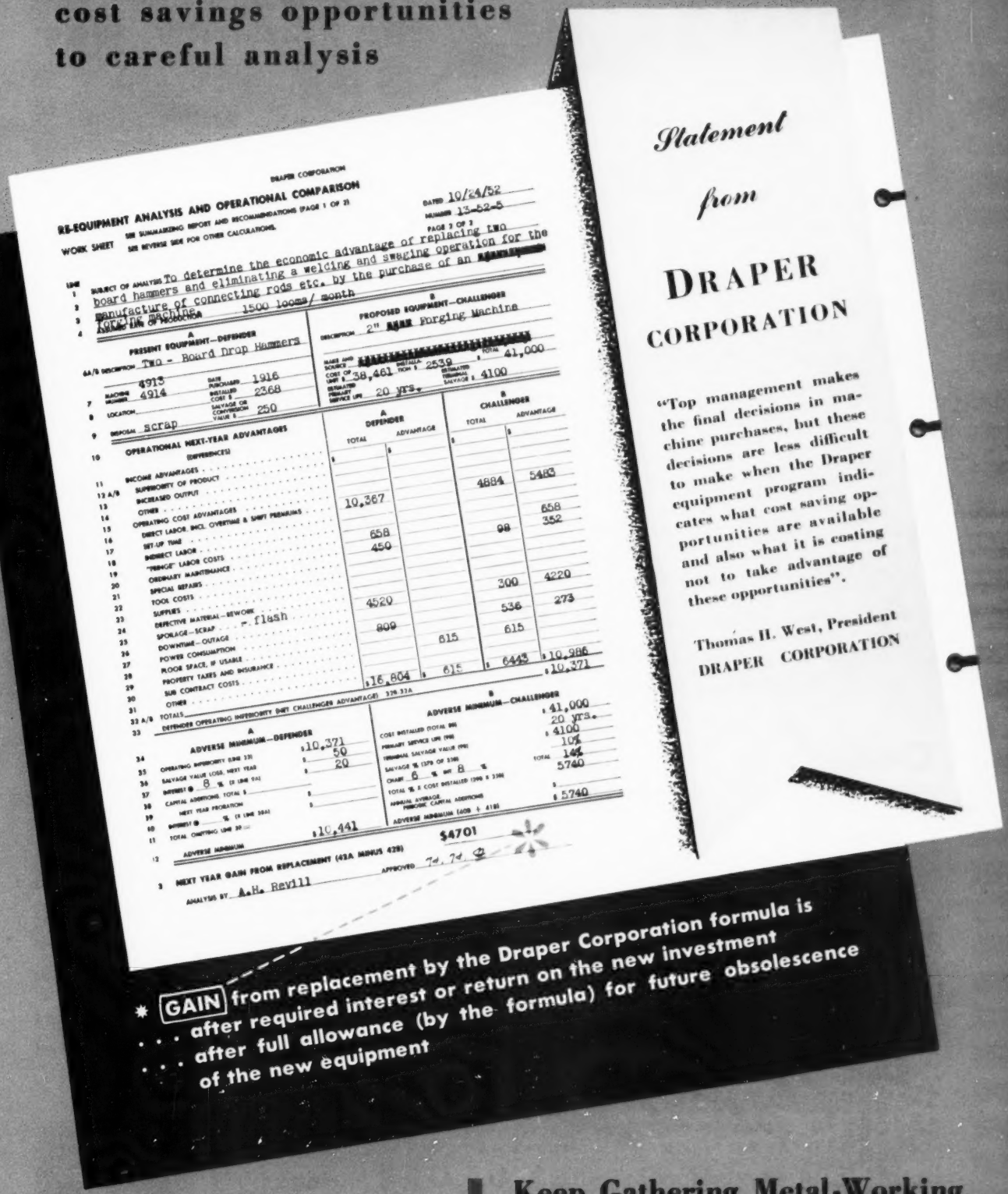
We invite your investigation and trial of these new gages, each designed to help YOU.

STANDARD Gage Co., Inc.
Poughkeepsie, N.Y.

Write for brochure on "NEW PRODUCTS" for more complete details on these instruments.

For more information on products advertised, use Inquiry Card, page 265

How the DRAPER CORPORATION reduces their cost savings opportunities to careful analysis



Statement from

DRAPER CORPORATION

"Top management makes the final decisions in machine purchases, but these decisions are less difficult to make when the Draper equipment program indicates what cost saving opportunities are available and also what it is costing not to take advantage of these opportunities".

Thomas H. West, President
DRAPER CORPORATION

* **GAIN** from replacement by the Draper Corporation formula is . . . after required interest or return on the new investment . . . after full allowance (by the formula) for future obsolescence of the new equipment

ROCKFORD INSERT GROUP

Keep Gathering Metal-Working Production Ideas . . . Be Well Informed When the Time for Replacement Arrives

July, 1954

reduce that part cost . . .

BROACH IT the *American* way

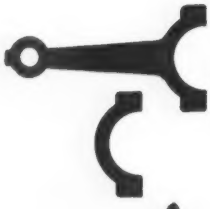
Broaching is a metal-cutting process that will remove stock to precision limits faster than any other metal-cutting process known — and will maintain those precision limits throughout production runs.

Below are a few jobs that have been done with American broaching tools and machines.

Broach and burnish round holes in refrigerator hub parts.

Broach splines and hole in automobile bevel gear.

Broach seven external slots in pump rotor part.



Broach jig pads and bolt seats on automotive connecting rods and caps.

Broach involute teeth and cam surface of gear part.

Regardless of how simple or complex your broaching application may be, American can furnish you broaching tools to meet your requirements in part tolerance and finish.

In addition to making all types of broaching tools, American builds broaching machines and fixtures, giving you a well-rounded manufacturing service. American backs up its products with a strong service organization that makes certain broaches, fixtures and machines installed by American will do the job for you.

So why not let American help solve your machining problems. Just send a part print or sample for a free estimate.

Write for Catalog 450. It describes American broaches, machines and fixtures.

AMERICAN *American* BROACH & MACHINE CO.

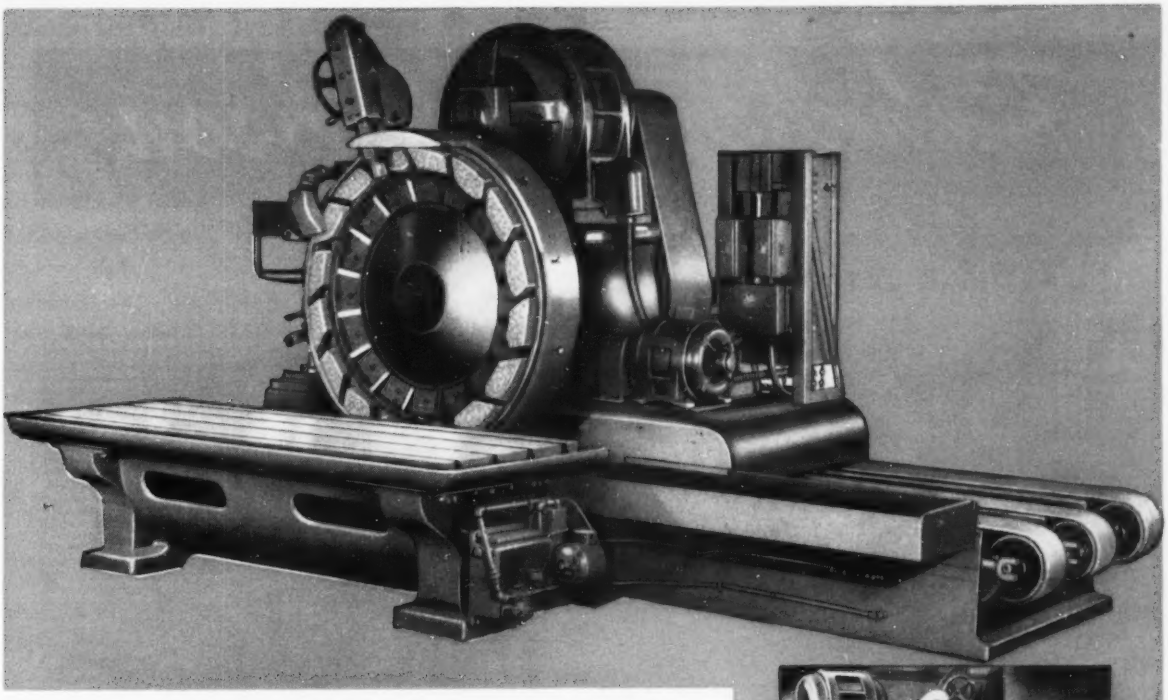
A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

SUNDSTRAND

American Building - Ann Arbor, Michigan

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

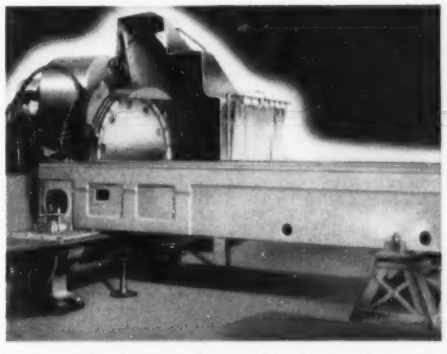


MATTISON TRAVELING WHEEL GRINDER FOR FAST FINISHING OF LONG OR LARGE PARTS

If your work consists of long or bulky parts, Mattison UK Traveling Wheel Grinders will finish them at a surprising rate of speed and accuracy and at very low cost. Large and awkward shaped pieces are frequently ground in a good deal less time than previous method. The part, no matter how large, is clamped in a stationary position and the grinding wheel passes across the surface to be finished. Amount of floor space needed is little more than half that required by traveling table machines of equal capacity. The operator's position on the carriage, together with the convenient grouping of all controls, makes for utmost grinding accuracy and speed regardless of the size of the job.

For further information, send for new free circular No. 844-2 RM covering this machine.

The operator rides the carriage of the UK Traveling Wheel Grinder. From this position he gets a safe unobstructed view of the grinding wheel at point of contact and can observe the work at all times.



Heavy work of practically any length can be rapidly ground to close tolerances with no more power required than for lighter work — the UK's table is always stationary. Picture shows end of 35′ base being ground.

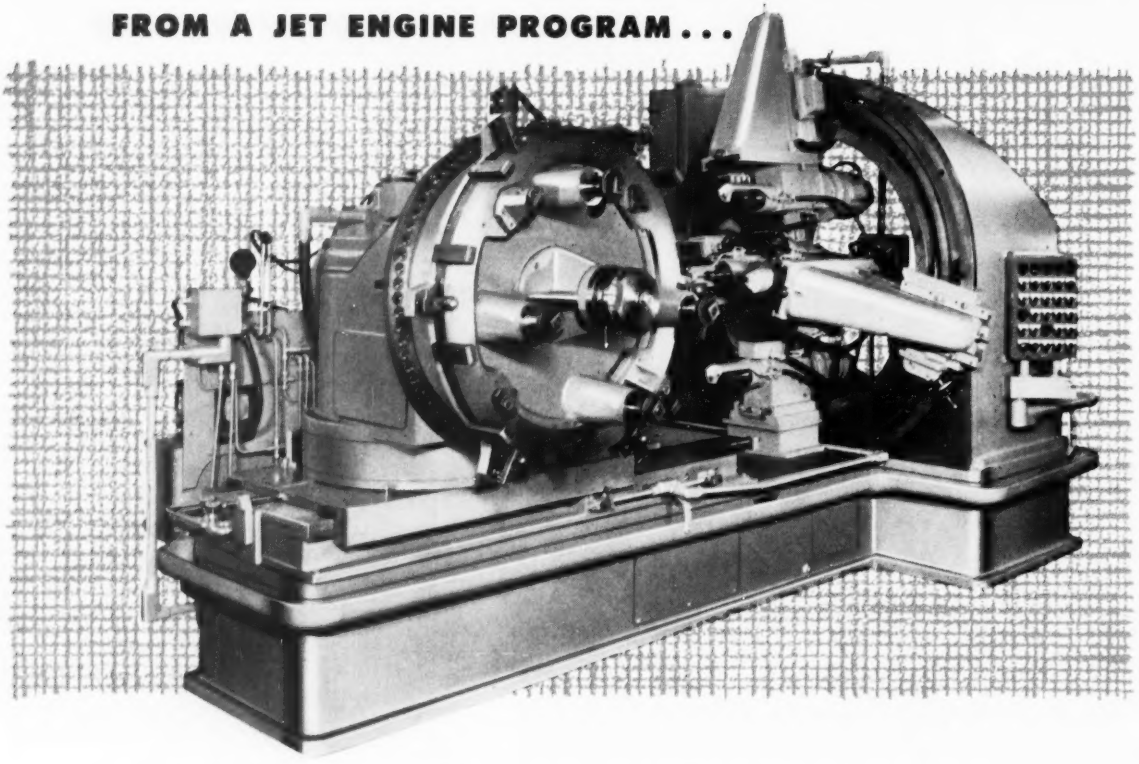
MATTISON MACHINE WORKS

ROCKFORD · ILLINOIS

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

Rehnberg-Jacobson

FROM A JET ENGINE PROGRAM . . .



HOW TO HOLD A DIFFICULT PIECE AND DRILL A LOT OF HOLES IN IT

The compressor housing of a big jet engine is a large and awkward magnesium-alloy "spider" that is hard to hold and hard to handle, and requires a large number of holes to be drilled in concentric bolt rings. Usual methods on ordinary machines proved unsatisfactory. The situation called for some ingenious ideas and a pioneering attitude . . . with the result that we came up with the machine shown above. The part is clamped onto the swung-out face of the index unit which then turns in and moves up, to present the piece to the fixed drill units. Index is accomplished by a link and drag pin for rotating the index head, and a locating pin for holding. The drilling heads, which are positionable in three directions, are also synchronized and controlled to drill the selected number of holes in each bolt ring. The machine is adaptable to several different, but similar, pieces and will accommodate a wide range of future engineering changes.

REHNBERG-JACOBSON MFG. COMPANY

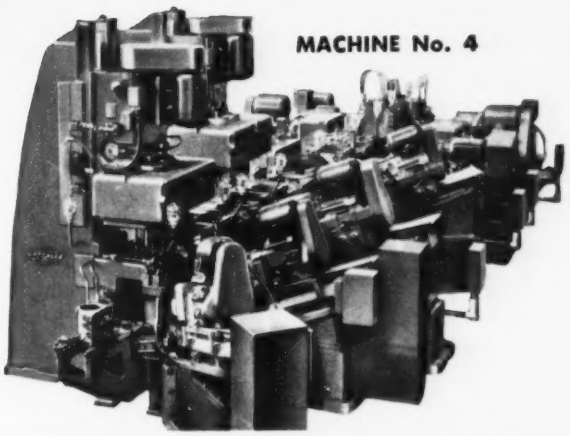
DESIGNERS & BUILDERS OF SPECIAL MACHINERY

2135 KISHWAUKEE ST. ROCKFORD, ILLINOIS

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

208 OPERATIONS IN 44.3 SECONDS

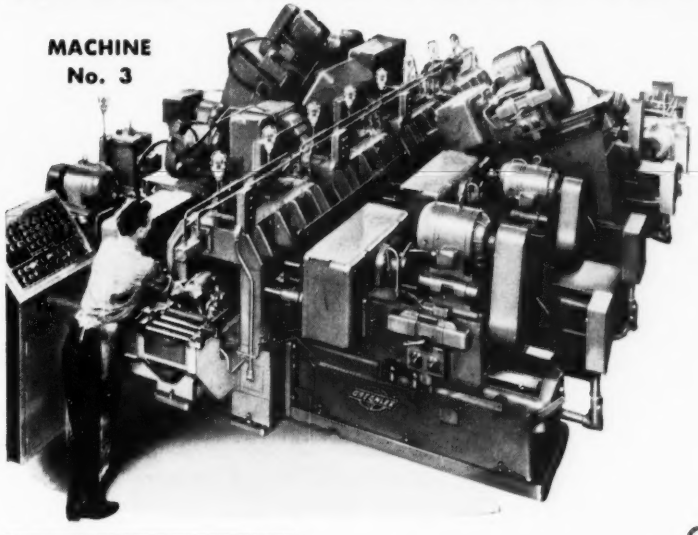
These recently-built Greenlee transfer machines mill, bore, drill, ream, and tap transmission cases for a well-known automobile. A total of 183 tools complete 208 operations in an automatic cycle time of 44.3 seconds. Features include face and end-milling heads, turnover and chip-cleanout stations, and indicator lights for tool changing. Self-contained hydraulic units conform to JIC standards for easy maintenance. These outstanding machines are among the newest built by Greenlee — a pioneer in progressive transfer-machine principles.



MACHINE No. 4

GREENLEE

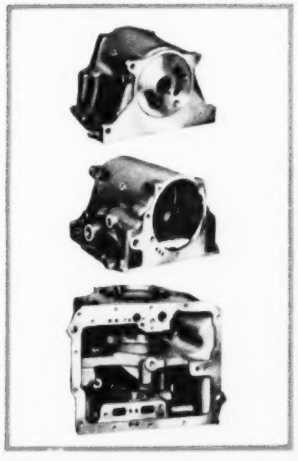
MACHINE No. 3

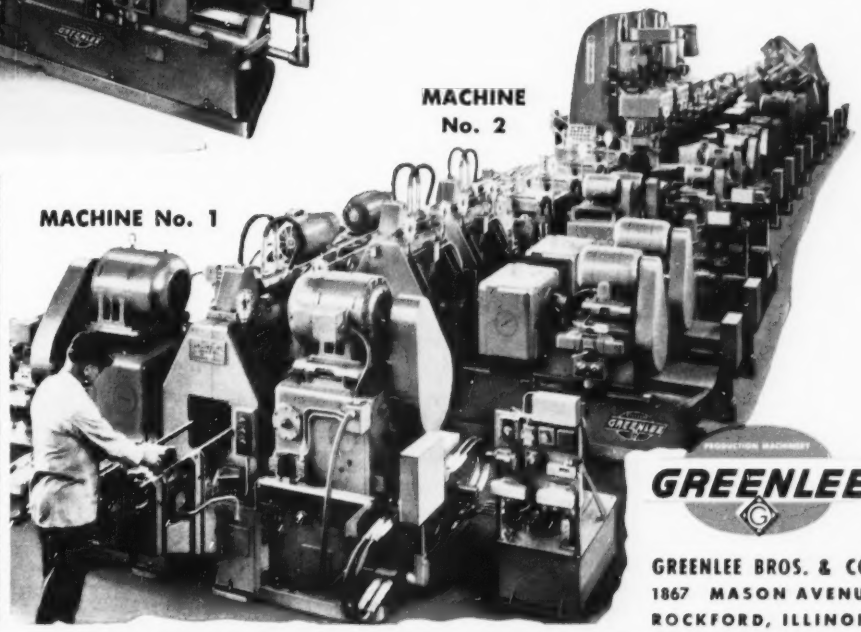


TRANSFER MACHINES
PROCESS
AUTOMATIC
TRANSMISSION CASES
AT THE PRODUCTION RATE OF
65 CASES PER HOUR

MACHINE No. 2

MACHINE No. 1



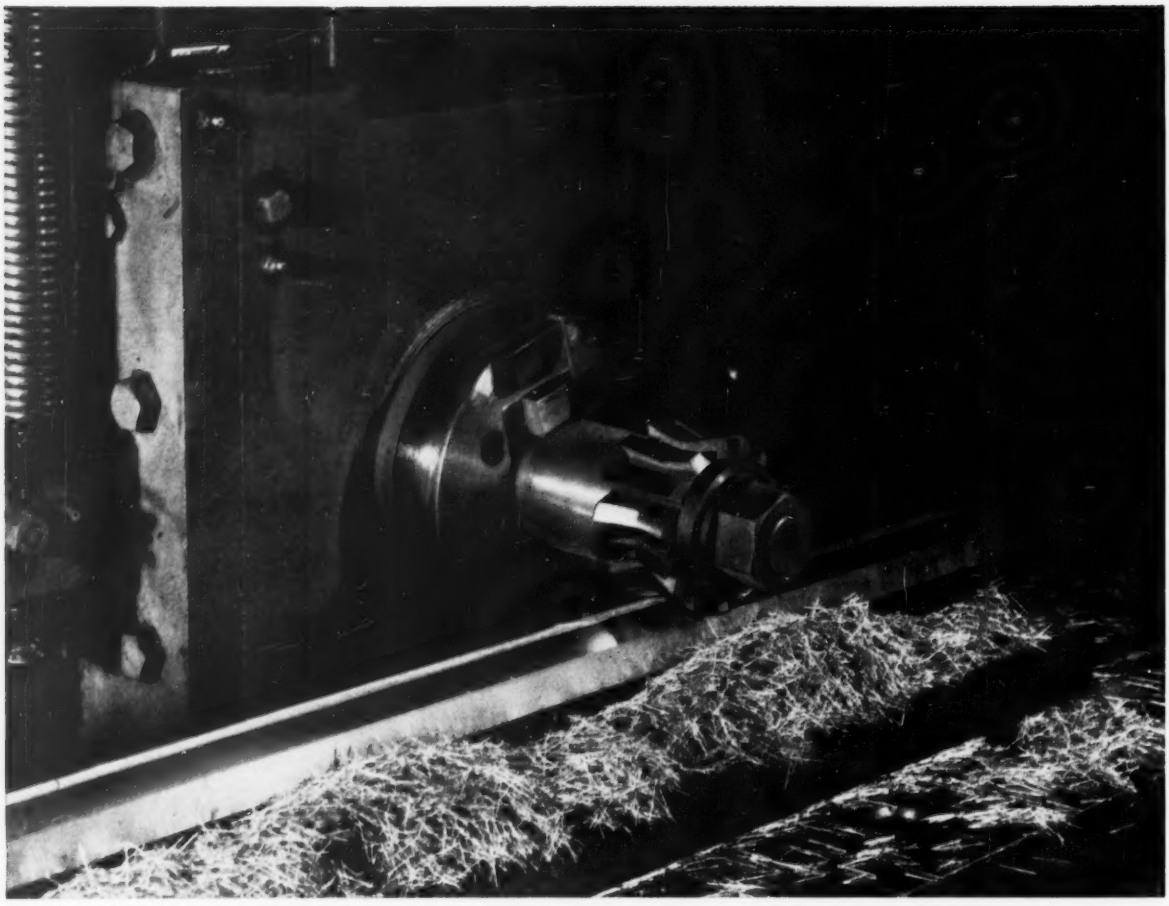


GREENLEE

GREENLEE BROS. & CO.
1867 MASON AVENUE
ROCKFORD, ILLINOIS

MULTIPLE-SPINDLE DRILLING, BORING, TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AUTOMATIC TRANSFER PROCESSING MACHINES

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**



SPECIAL FORM CUTTER DESIGN

Reduces Set-Up Time, Eliminates Hand-Scraping

CUTTERS MILL WAYS 7-FEET LONG

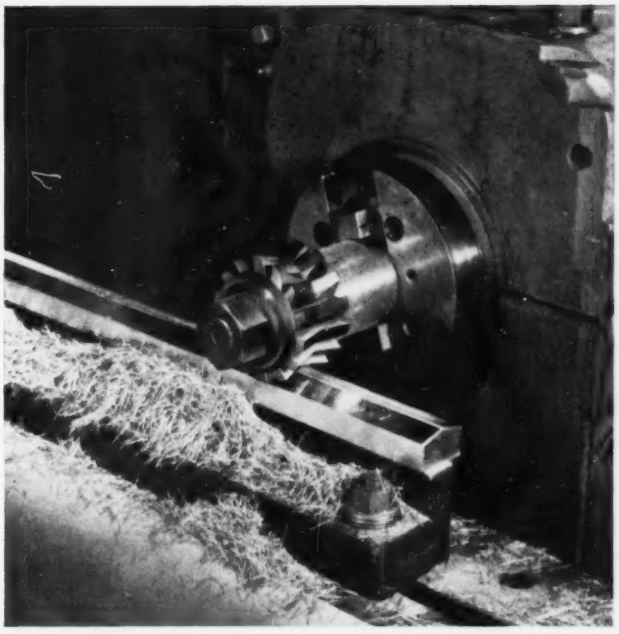
These double-angle form cutters are used to mill conveyor-ways 7 feet long for production-type woodworking machines. They machine the surface of these ways accurately to eliminate the need for hand scraping. They replace previous gang-type cutters which required special care in sharpening, as well as additional set-up and adjustments on the milling machine in order to produce the desired accuracy.

ACCURACY AND FINE FINISH

The accuracy of the form on these ways is built into the cutter. The form on this ground cutter must fit the layout within .0005″. By simply sharpening the cutter accurately across the faces of the teeth, this accuracy can be maintained throughout the life of the cutter. The only adjustment required in setting up the machine is to true the cutter on the arbor. The cutter is designed with fourteen teeth on a 4″ diameter to provide the fine finish required on these ways.

DESIGNERS OF STANDARD AND SPECIAL

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**



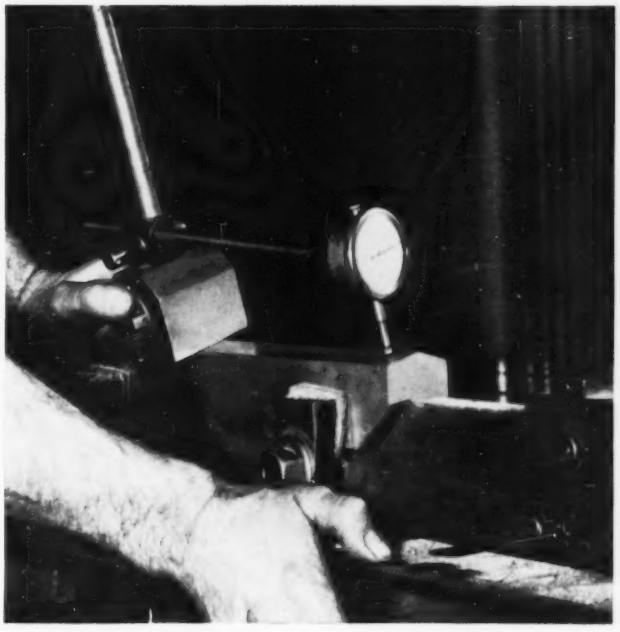
GOOD TOOL LIFE IN TOUGH MATERIAL

Material is special bronze and there is some irregularity in toughness. Tool life up to 30 pieces per sharpening is obtained at 3/8″ feed and 150 RPM, depending upon the consistency of the material. Milling removes .008″ stock.

BUILT-IN ACCURACY AT NO EXTRA COST

Barber-Colman form-relieved cutters are checked for accuracy of index and concentricity through every manufacturing step. This quality control requires extra operations. However, as a result of this control, Barber-Colman form-relieved cutters retain their original tool accuracy throughout their cutting life. There is no need to cylindrical-grind and spot sharpen the teeth since the cutters are within close tolerances for both index and concentricity. Cutters need sharpening only across the faces of the teeth. Maintenance costs amount only to face sharpening at intervals consistent with good tool life.Why not try Barber-Colman form-relieved cutters on your next production milling job and experience the satisfaction of having fewer adjustments, simplified tooling, faster production and trouble-free machining.

Send Us Samples or Prints for Analysis On Any Form-Relieved Cutter Applications



HOBS • CUTTERS • REAMERS
HOBBING MACHINES
HOB SHARPENING MACHINES

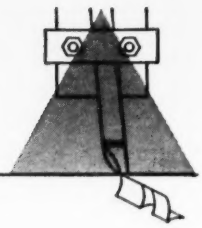
BARBER COLMAN

Barber-Colman Company

GENERAL OFFICES AND PLANT, 827 ROCK STREET, ROCKFORD, ILL.

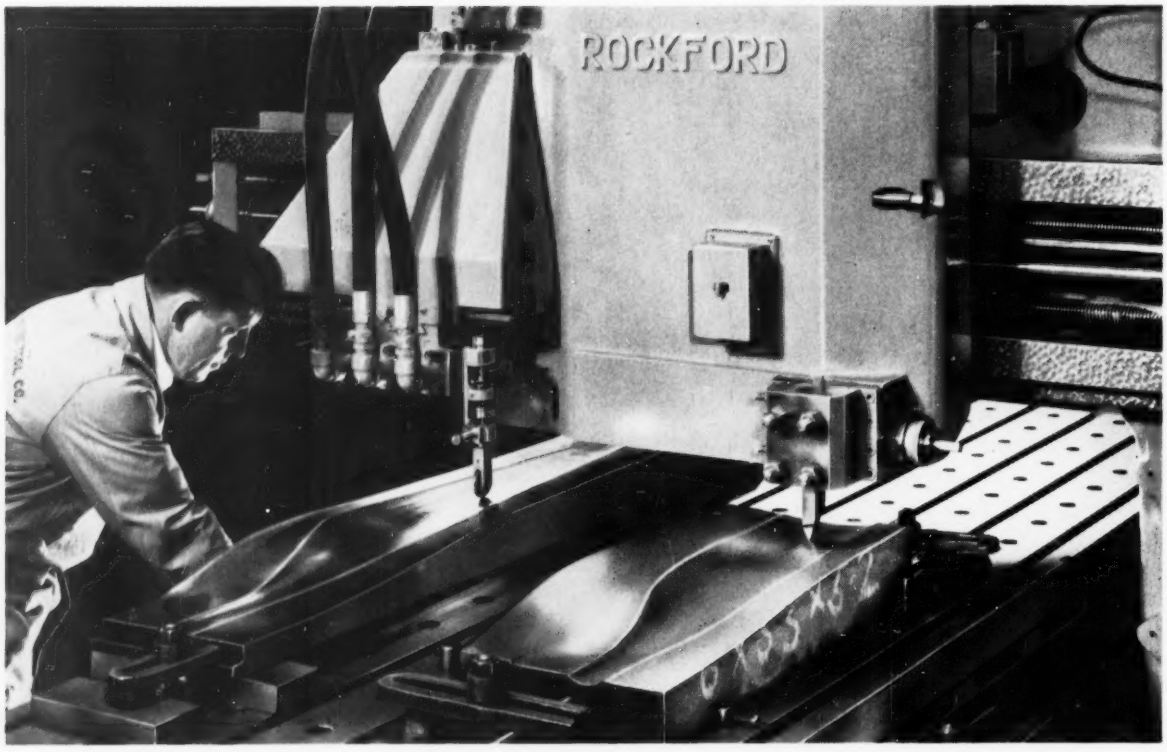
METAL CUTTING TOOLS SINCE 1908

FOR PRODUCTION MACHINE TOOLS IT'S ROCKFORD, ILLINOIS, U.S.A.



a cost cut . . . with every stroke of rockford kopy-kat hydraulic

duplicators



higher production is obtained with every stroke **because...**

the unique Kopy Kat duplicates automatically. Its hydraulic duplicator valve is so sensitive, so exact, that positive duplication of complex forms is done with the ease of straight-production machining.

Ask us for recommendations for your duplicating shaping, planing, slotting and turning work.

OUR 52nd YEAR

ROCKFORD MACHINE TOOL CO.

2500 KISHWAUKEE STREET • ROCKFORD, ILLINOIS

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

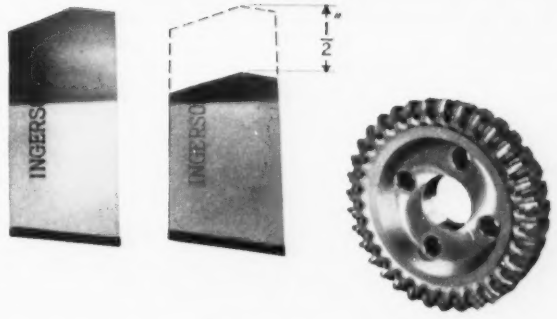
INGERSOLL REPLACEMENT BLADES

The *longer cutting life* of Ingersoll replacement blades should be a primary consideration in the purchase of cutting tools. High quality Ingersoll precision blades designed for Ingersoll milling cutters give better performance at low cost for these reasons . . .

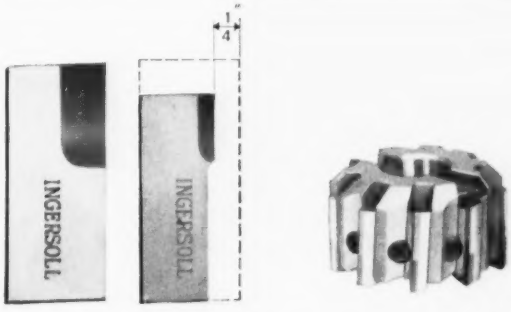
- √ **Use of efficient, up-to-date production equipment** in the manufacture of blades and cutters.
- √ **Integrated design of blades and cutter** for most effective cutting action.
- √ **Specific grades and correct arrangement of carbide** in blades for your particular work.
- √ **Value of knowledge and experience** gained during 65 years of building special machines and cutters to meet varying customer needs.

Most standard Ingersoll blades are available from stock . . . carbide-tipped, cast alloy, high speed steel . . . plain, serrated, helical.

1/2" OF CUTTING LIFE FOR $1.40



Costing only $1.40, this carbide-tipped blade for an Ingersoll Shear Clear Face Mill gives as much as ½" of wear while rough milling cast iron at high feed rates.



¼" of blade life for $1.00. Carbide-tipped blade for Ingersoll 4" dia. Type NX Face Mill.

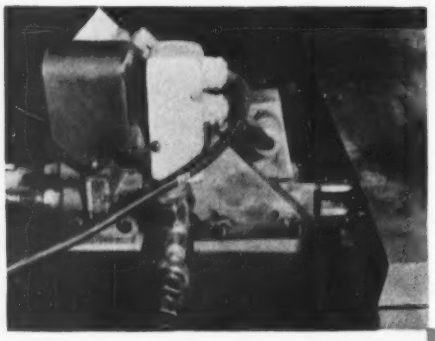
5/16" of blade life for $1.95. 3½" long, high speed steel twisted blade for Ingersoll Helical End Mill.

Write for Catalog 60B, describing Ingersoll inserted blade face mills, end mills, helical slab mills, side mills, arbor cutters, angular cutters and boring heads.

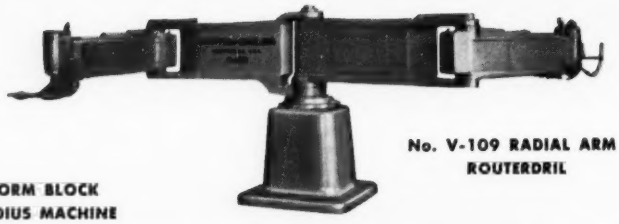
THE INGERSOLL MILLING MACHINE COMPANY
ROCKFORD, ILLINOIS, U. S. A.

BUILDERS OF SPECIAL DESIGN MILLING & BORING MACHINES
ORIGINATORS OF SHEAR CLEAR CUTTERS

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**



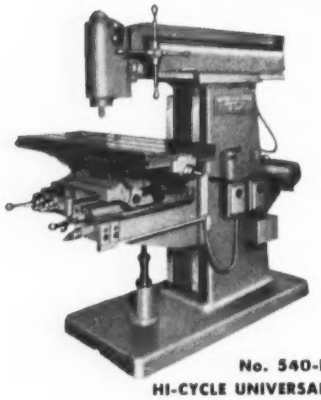
FORM BLOCK
RADIUS MACHINE



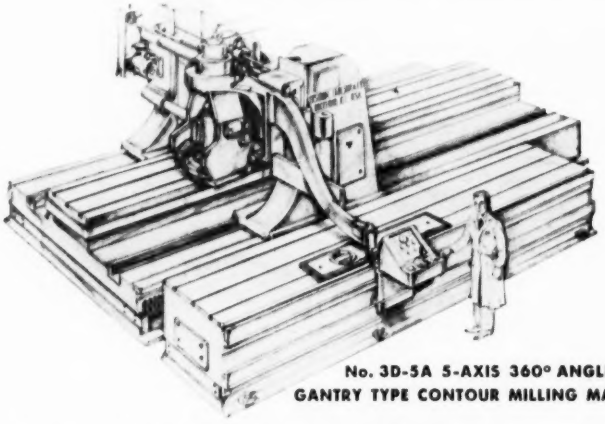
No. V-109 RADIAL ARM
ROUTERDRIL

FOR GREATER AIRCRAFT PRODUCTION!

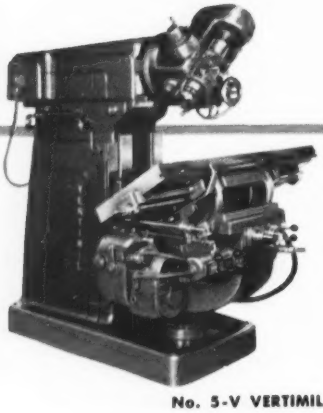
New concepts—new designs—new mechanisms—new highs in production capacities—new standards of performance . . . these outstanding attributes are typical of Ekstrom, Carlson & Co. products for the aircraft industry! Look over the many items shown here—pick out those that may fit your present and future plans—then write for free literature giving full and interesting information.



No. 540-HC
HI-CYCLE UNIVERSAL ROUTERMIL

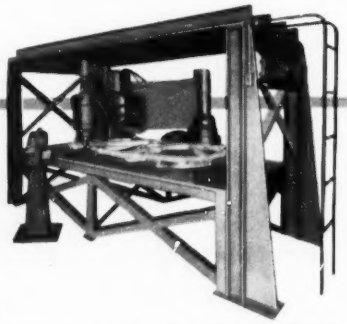


No. 3D-5A 5-AXIS 360° ANGLE
GANTRY TYPE CONTOUR MILLING MACHINE



No. 5-V VERTIMIL

MACHINES *and*



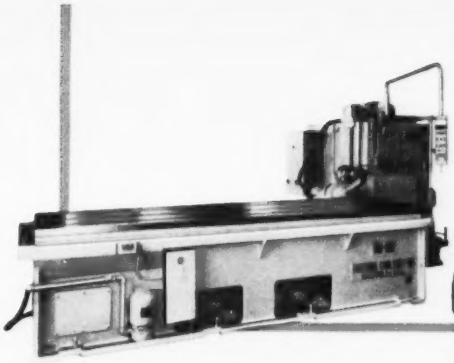
No. E-121-OH
CAVITY
MILLING MACHINE

Write for More Information

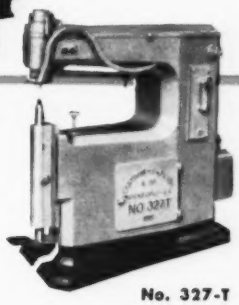
EKSTROM, CARLSON & CO., DEPT. M-4, 1400 RAILROAD AVE., ROCKFORD, ILL.

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

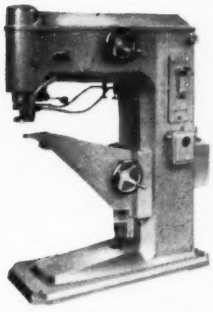
No. 71C-DS
2-SPINDLE RADIAL ARM DRILL



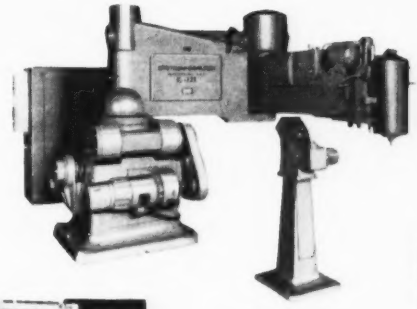
No. SM-100
SCARF AND EDGE
MILLING MACHINE



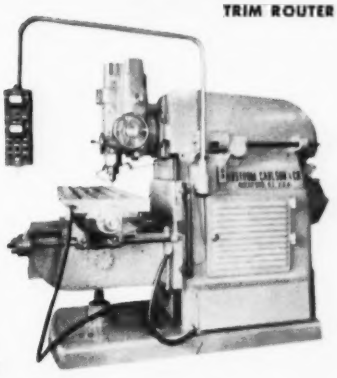
No. 327-T
TRIM ROUTER



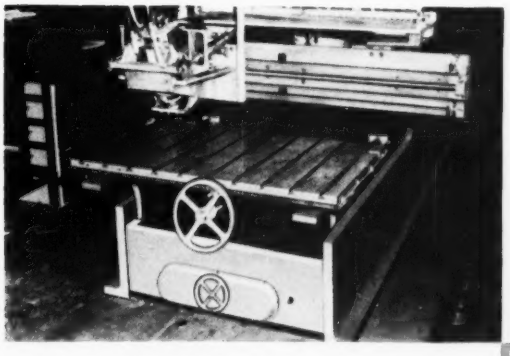
No. 434-H HORN ROUTER



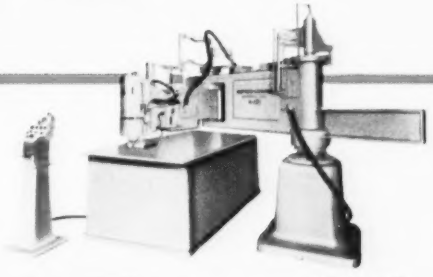
No. E-121
ALL-ELECTRIC
CONTOUR ROUTER



No. 6-E VARI-SPEED
VARI-FEED COMPOUND
VERTICAL MILL



CONTOUR AND BEVEL ROUTER

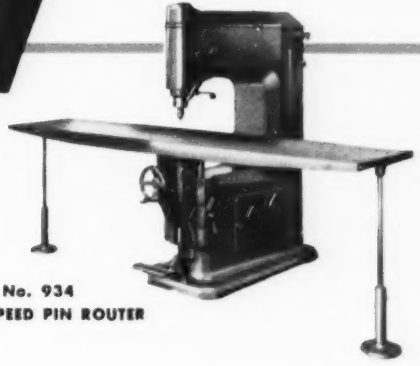


No. H-121
HYDRAULIC-ELECTRIC CONTOUR ROUTER

TOOLS...

by EKSTROM, CARLSON

SPIRAL FLUTE ROUTER BITS



No. 934
HIGH SPEED PIN ROUTER

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

precision Size Control • high Production

TRANSFER HONING TRANSMISSION CASES

with BARNESDRIL

Plugmatic Bore-To-Bore Sizing • Electronic Hone Expansion

Greater Precision

Plugmatic gauging member sizes the work being honed. Is self-aligning and is not affected by misalignment or eccentric stone wear.

High Production

Automatic electronic control of hone expansion and compensation for stone wear keeps honing operation at peak efficiency.

Selected Finish

With electronic hone expansion control, the finish is accurately determined by the selection of the proper rate of feed and by grit, grade and bond of abrasive stones.

Geometric Accuracy

Is generated and maintained within .0003" on these blind-end bores with limited overrun, by proper selection of honing tool and abrasive.

Cast Iron Transmission Case

Blind-End Bore: 2.875" x 1.625"

Automatically Sized Bore-To-Bore: within .0003"

Geometric Accuracy: within .0003"

Production: 180 pieces per hour

Finish: 20 to 25 R.M.S.

Write or phone for a Barnesdril honing engineer to assist you with any honing problem. Ask for Bulletin No. 500.

HOLE BARNESDRIL FINISHING

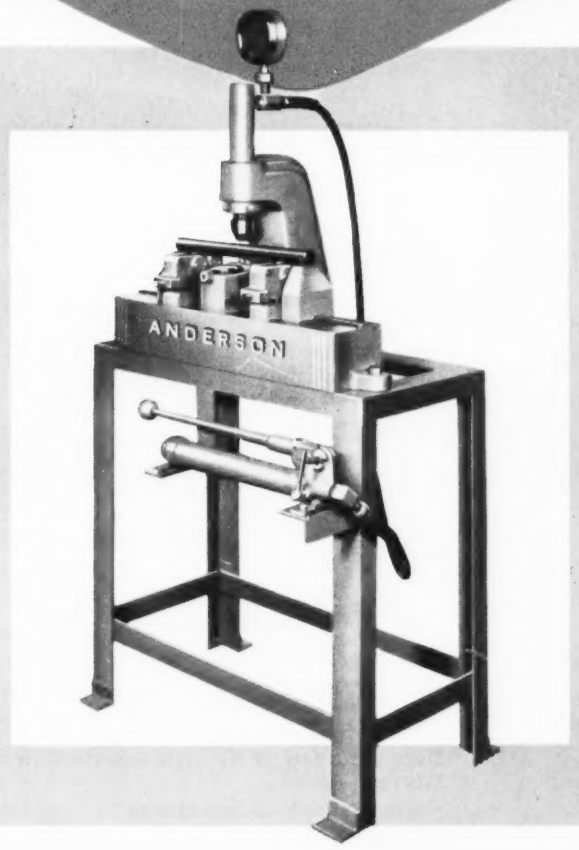
BARNES DRILL CO.

820 CHESTNUT STREET • ROCKFORD, ILLINOIS

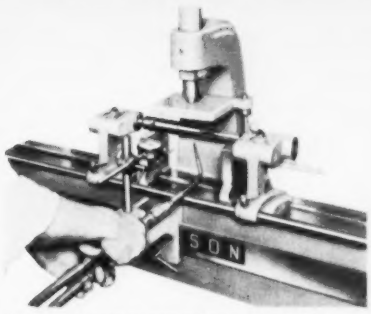
CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

ANDERSON HYDRAULIC HAND PRESS

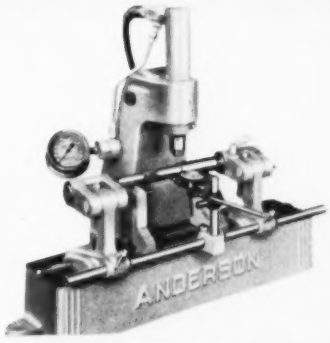
GET IT STRAIGHT ...FAST



The Anderson Hand Press checks and bends in the same position. When the work is released from the bending position, spring tension on the rolls brings the work free of anvils to rotate easily for checking. The presses are extremely versatile . . . checking rolls are easily adjusted to various shaft lengths . . . capacities are 10 and 20 tons with stationary rams and 20 and 50 tons with traveling rams. Write for Bulletin 7-6, today. See how an Anderson Hand Press can save money for you.

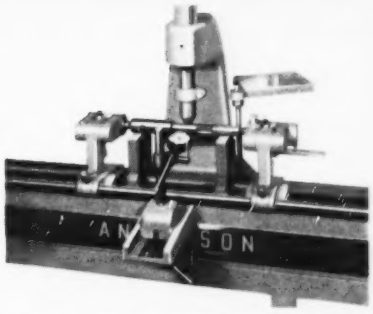


High speed reamers require heat when straightening. The Anderson indicator can be pulled back out of the way.



A special pressure gauge adapter is available for high production work . . . another Anderson feature.

Checking and straightening round bars on spring loaded rollers.



Checking work with various diameters on spring loaded centers and adjustable anvils.

Anderson

ANDERSON BROS. MFG. CO.

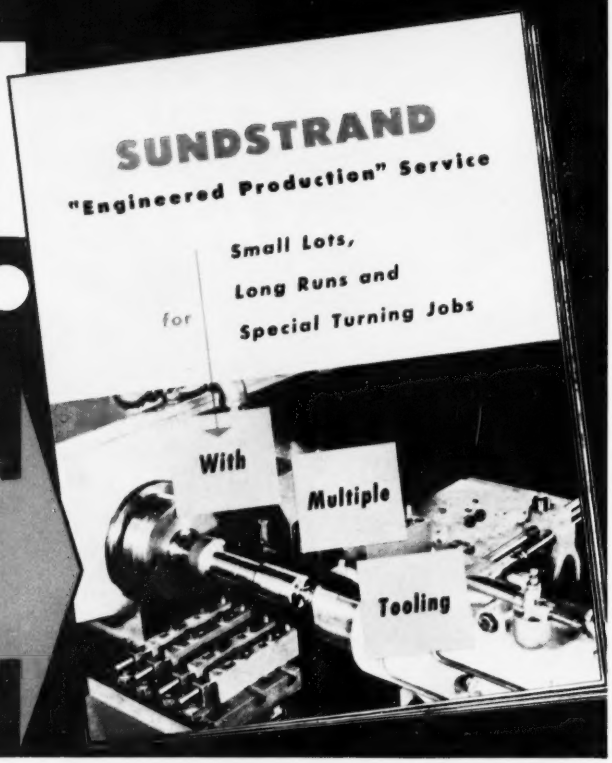
1907 KISHWAUKEE STREET

ROCKFORD • ILLINOIS

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

NEW!

MORE VALUABLE INFORMATION ON TOOLING



Here is some new proof of the productive versatility of Sundstrand Automatic Lathes. The information presented in this new book is taken direct from the field-checked and re-checked for accuracy and presented to you so that you may compare the performance of your present turning equipment with the outstanding performance obtained with Sundstrand Automatic Lathes in other plants.

Included in the book are on-the-job action photos and tooling diagrams describing actual applications from modern manufacturing plants.

32 PAGES OF JOB FACTS, TOOLING TIPS AND TECHNICAL DATA

Here are a few of the jobs described in this new book —

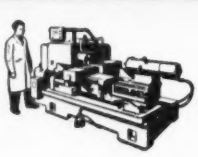
- Practical tips on tool setting.
- Turning cylinder liners.
- Turning worm gears and hubs.
- Turning bearing races.
- Turning spherical surfaces.

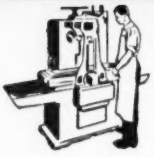
ALSO . . .

- How to select the proper lathe.
- How to set up the Sundstrand Automatic Lathe.

AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS

SUNDSTRAND "Engineered Production" Service*
*REG. U.S. PAT. OFF.





CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

SOME OF THE VALUABLE INFORMATION YOU'LL FIND IN THIS BOOK

1 *Practical Tips on Tool Setting*

Two pages of information on setting tools five different ways includes setting tools from master samples, setting tools without master samples, setting tools from tool block gages, setting tools to template and setting tools in magazine.

2 *Multiple Tool Turning In Small Lots*

Nine different job examples are shown on small lot turning of cylinder liners, various shafts, bearings, gear blanks etc. Lot sizes range from 20 to 3000 pieces.

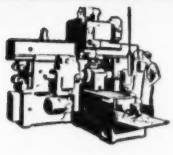
3 *Special Turning*

Six widely different solutions to special lathe production problems are shown along with part illustrations and tooling diagrams. Also included are seven long-run turning jobs.

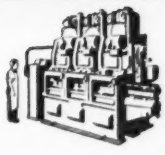
Everyone interested in increasing production will find valuable suggestions in this book

You'll find many lathe jobs similar to yours in this book. You'll also find valuable production data to compare with your present equipment. Write for your copy now. Ask for book 645.

TRIPLEX RIGIDMILS



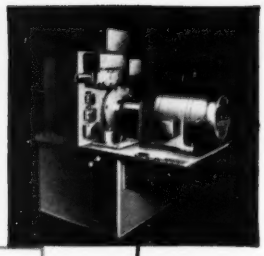
SPECIAL MACHINES

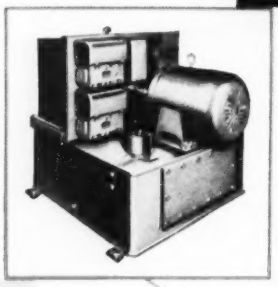


SUNDSTRAND
Machine Tool Co.
2530 Eleventh St. • Rockford, Ill., U.S.A.

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

alone

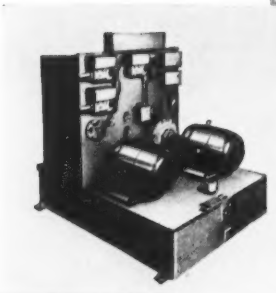


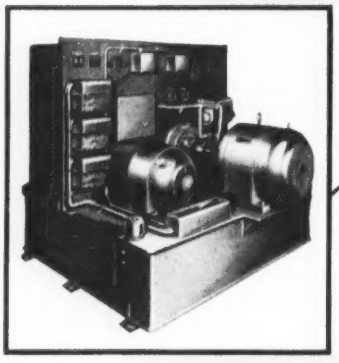


BARNES

HYDRAULIC

POWER UNITS





The various elements supported by the units are so arranged as to facilitate servicing by maintenance men such as: electricians, hydraulic servicemen, fixture servicemen, tool makers, etc.

All units are uniform in design and arrangement of elements — differing only in size.

Attention — please note that regardless of unit size, the location of all elements remains the same.

BRANCH OFFICES

503 New Center Building
Detroit 2, Michigan

3254 Lincoln Avenue
Chicago 13, Illinois

132 East Hanover Street
Trenton 8, New Jersey

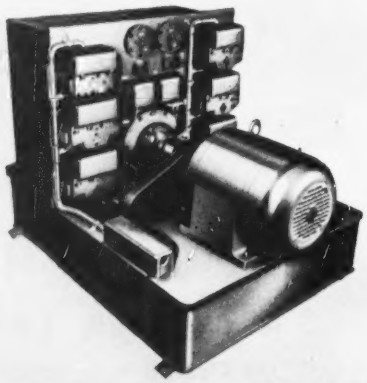
SALES REPRESENTATIVES

Rees Machinery Company
1012 Empire Building
Pittsburgh 22, Pennsylvania

B. W. Rogers Company
850 South High Street
Akron 9, Ohio

Standard Machine & Tool Co.
870 Ottawa Street
Windsor, Ontario, Canada

W. H. Del Mar Co.,
3931 W. Slawson Ave.
Los Angeles 43, California



Barnes Machine Tool Power Units conform to the JIC Code.

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JOHN S. BARNES CORPORATION ROCKFORD, ILLINOIS

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

measuring up

...and REX is the standard by which all high speed steels are compared

An older brother sometimes makes a handy yardstick for measuring junior's growth. And when it comes to tool steels, REX® High Speed Steel is — and has been for over 50 years — the standard of comparison.

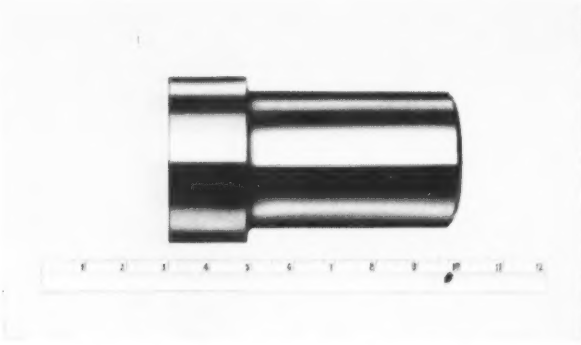
There's no mystery to REX High Speed Steel. Its quality has been time-tested in thousands of shops. And after all, it's performance — not claims — that really counts. Make your *own* comparison test. Put REX High Speed Steel to work. Compare its structure, finish, hardenability, carbide distribution and general uniformity. You won't find another high speed steel that surpasses REX.

Remember, too, that even though it is widely distributed and used, REX High Speed Steel is made *only* by Crucible. So for tops in high speed steel performance, be sure you order the Crucible REX brand.

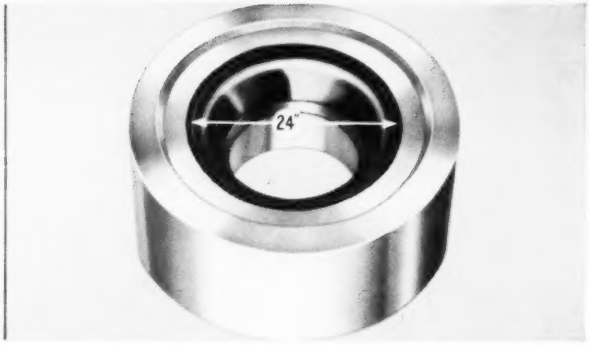
CRUCIBLE first name in special purpose steels

54 years of Fine steelmaking **TOOL STEELS**

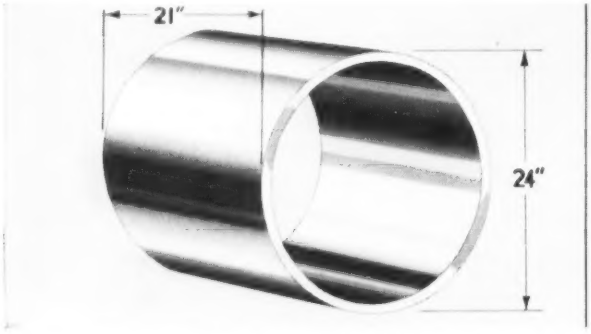
CRUCIBLE STEEL COMPANY OF AMERICA · TOOL STEEL SALES · SYRACUSE, N. Y.



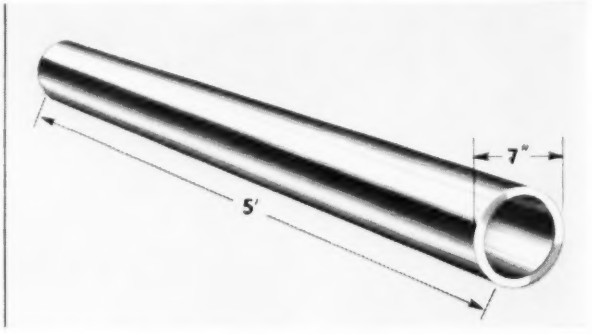
Solid carbide punch used in the cold extrusion of steel.



Ring dies up to 24" I.D. produced one piece.



Carbide cylinders up to this size produced one piece.



Carbide cylinders up to this size produced one piece.

2-Ton Cemented Carbide pieces can solve your toughest wear problems

New manufacturing facilities at the Carboloy Department of General Electric Company are capable of producing pieces of cemented carbide up to 4,000 pounds, including –

large die sections

rolls for rolling strip steel

large punches for cold extrusion work

large, wear-resistant linings for brick molds

When you replace present parts–large, medium size or small, with Carboloy cemented carbides, maintenance costs come down, production goes up.

Carboloy engineers are ready to assist manufacturers and diemakers to determine where and how Carboloy cemented carbides can cut costs, boost production. Write for this free service.

CARBOLOY

DEPARTMENT OF GENERAL ELECTRIC COMPANY

"Carboloy" is the trademark for products of the Carboloy Department of General Electric Company

Carboloy, Department of General Electric Company
11147 E. 8 Mile Road, Detroit 32, Michigan

Gentlemen:

Could large pieces of cemented carbide reduce costs in the following applications:

Please have a Carboloy engineer –

☐ call at plant.

☐ call for appointment.

Name

Title

Company

Address

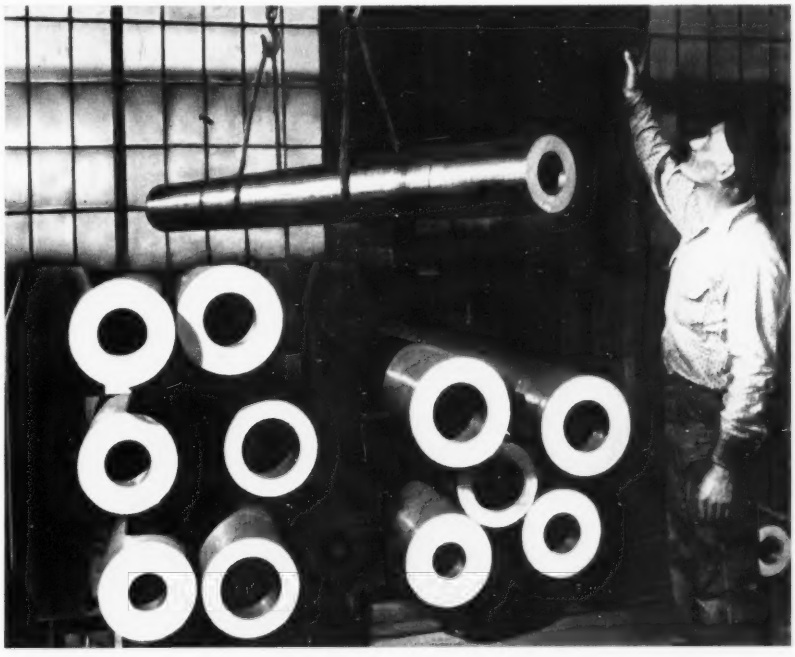
City Zone State

For more information on products advertised, use Inquiry Card, page 265

Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation



New Tool Steel Saves Production Time

BTR HOLLOW-BAR IDEAL FOR ALL RING-TYPE APPLICATIONS

Making ring dies? Draw rings? Ring gages? Back up rings? Then you'll want to use BTR Hollow Bar, a new Bethlehem tool steel which is especially designed for this type of service.

BTR stands for "Bethlehem Tool Room," our popular oil-hardening tool steel. BTR Hollow Bar is made by an improved Bethlehem process called High-Speed Trepanning. By this method, the center metal of the hammer-forged round bars is cored out and the bars are then rough-turned on the outside.

BTR Hollow Bar saves production time and delivery time because your distributor can cut off rings from the bar to any desired length. It also enables you to save shop time, because there's no need to wait for forged rings or discs. What's more, in most instances there's no drilling, rough turning, rough boring, or rough facing required.

BTR Hollow Bar is furnished in the annealed condition to a Brinell of 202 max, and is smooth-machined on both the inside and outside surfaces. Stock lengths for small sizes are 6 ft to 8 ft, and for large sizes 8 ft to 12 ft.

Typical Analysis

Carbon	0.90	Chromium	0.50
Manganese	1.20	Tungsten	0.50
		Vanadium	0.20

If you'd like to know more about Hollow Bar, talk it over with your distributor. Or write to us at Bethlehem, Pa.

66 HS MACHINES CAR WHEELS

Here the rim contour and front face of a "one-wear" wrought steel freight car wheel are being machined. The average depth of cut is 1/32 in. Both the roughing and finishing tools used in this machining operation are made of Bethlehem 66 HS. This is our moly-tungsten grade of high-speed tool steel. In addition to featuring wear- and shock-resistance, 66 HS also has good red-hardness.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

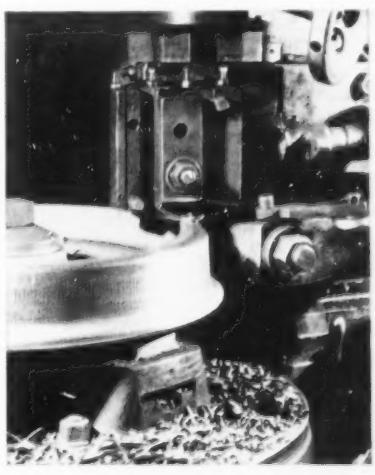
It Doesn't Pay to Punch All the Way Through

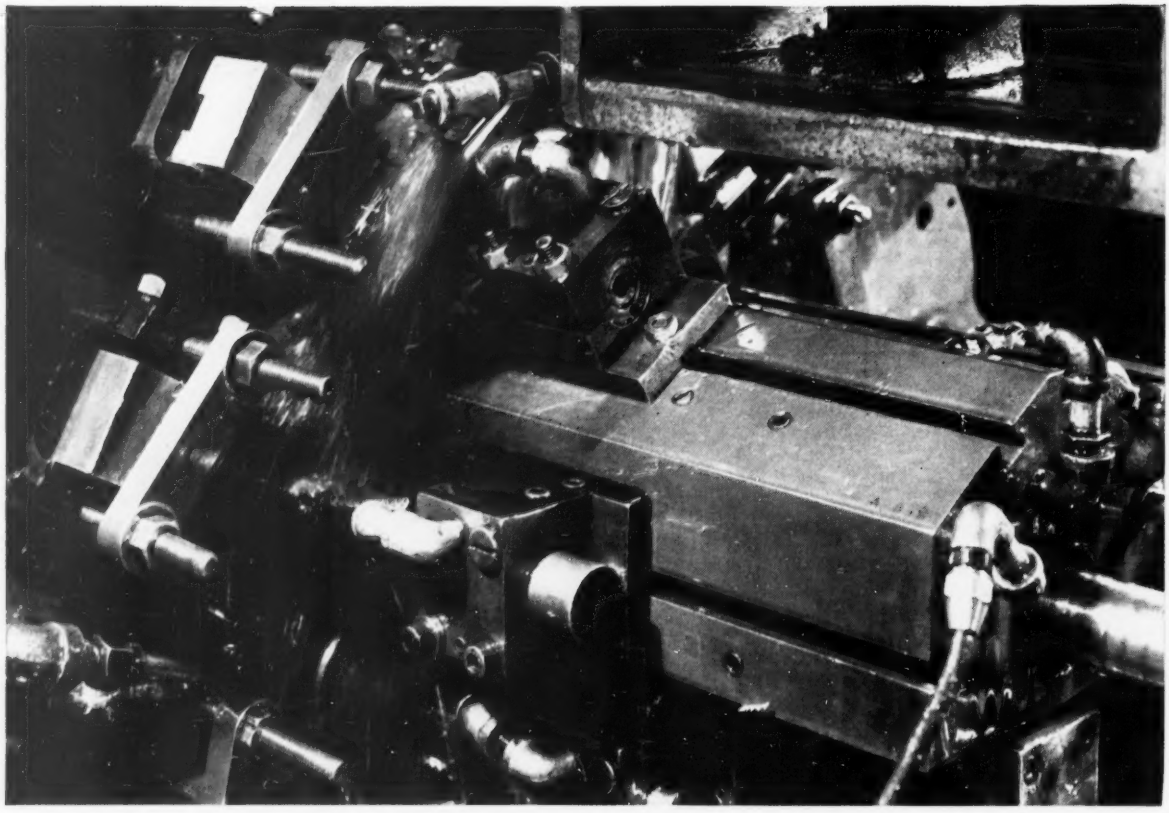
One of the best ways to improve the tool life of punches is to control the stroke of the punch. It is not necessary for a punch to go completely through the hole. When a punch does go through the hole, rapid wear occurs. This increases clearance, which in time increases the load necessary for punching, and results in burred edges.

When a punch has penetrated part way through the stock, "snapping" occurs and the "button pops out." The amount of penetration of punch before "snapping" takes place depends upon the material being punched, and the stock thickness. In general, the softer the material the greater the penetration required; conversely, a hard or brittle material requires less penetration.

The penetration on soft, thin stock may be as high as 90 pct of the stock thickness. On hard, thick stock it may be as low as 40 pct. The least amount of penetration which will bring out the "button" is best. What the penetration should be must be determined on each job.

Proper control of penetration of the punch by adjustment of the stroke of the press will pay off in decreased wear on the punch, resulting in better quality parts and increased tool life.





Are your automatics turning out what they could?

Let's say you've checked the machine itself. The tools. The setup. The feeds and speeds. And you find them O.K.

You may still be missing your peak production because of the steel you're using.

Many manufacturers have found that switching to Republic Cold Drawn Alloy Steels has given them the qualities they want in steel parts. And it's also given them the cost-cutting advantages that are built into high-speed automatics. Here's how it works.

Designers can make full use of Republic Cold Drawn Alloy Steel's high strength and uniform structure. Production men get the ideal combination of wear-ability and strength from the uniform hardenability and toughness of alloy steel.

And you get uniform machinability as well.

Republic's 3-D Metallurgical Service is ready to help you get the best out of Republic Cold Drawn Alloy Bars. A phone call to your nearest Republic District office may uncover the answers to some of your tough cost and production problems.

REPUBLIC STEEL CORPORATION
Alloy Steel Division • Massillon, Ohio
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, N. Y.

REPUBLIC COLD DRAWN ALLOY STEEL BARS

Other Republic Products include Carbon and Stainless Steels—Sheets, Strip, Bars, Wire, Pig Iron, Steel and Plastic Pipe, Bolts and Nuts, Tubing

For more information on products advertised, use Inquiry Card, page 265

Experience is Invaluable Producing Aircraft Forgings

Working with the aircraft industry for many years has given National Forge the experience and special skills so necessary to turn out finished forgings such as these helicopter masts.

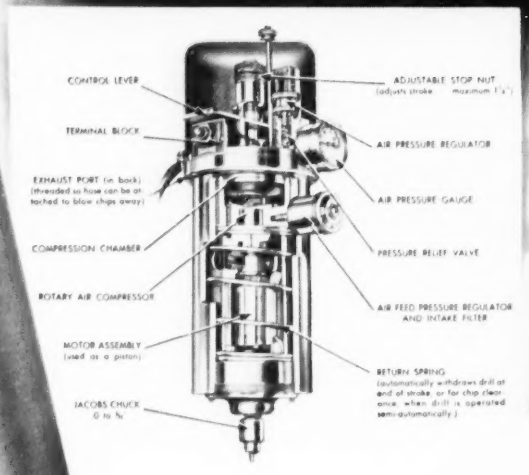
These forgings, being finish machined and inspected at National Forge, are ready for installation. They have been heat-treated, machined and plated at National Forge. Constant checking and inspection assure absolute machining accuracy and highest quality in both metallurgical and physical properties. Each forging must be identical to the other to insure interchangeability.

Whether your forging problem involves complete production from electric steel making to finish machining or any process along the way, National Forge is equipped to handle it. Just write:

National Forge
AND ORDNANCE COMPANY
Irvine, Warren County, Pennsylvania

STEEL MAKERS ☆ FORGESMITHS
HEAT TREATERS ☆ MACHINISTS

DIE CAST OF ZINC


CONTROL LEVER
TERMINAL BLOCK
EXHAUST PORT (in back) (threaded so hose can be attached to blow chips away)
COMPRESSION CHAMBER
ROTARY AIR COMPRESSOR
MOTOR ASSEMBLY (used as a piston)
JACOBS CHUCK 0 to ½
ADJUSTABLE STOP NUT (adjusts stroke maximum 1½")
AIR PRESSURE REGULATOR
AIR PRESSURE GAUGE
PRESSURE RELIEF VALVE
AIR FEED PRESSURE REGULATOR AND INTAKE FILTER
RETURN SPRING (automatically withdraws drill at end of stroke, or for chip clearance, when drill is operated semi-automatically.)

for DUMORE

Here's Why.....

Since the above part is the largest single component of the pictured Dumore automatic drill head, the selection of material and process for its production was of paramount importance in achieving high efficiency and low cost of the finished product. The following factors dictated the choice of ZINC Die Casting:

Rapid Production—Because of the extreme complexity of shape and close tolerances attainable with ZINC Die Castings, an absolute minimum of secondary operations—burr removal, drilling, tapping, burnishing—are required to place this housing in service.

Low Cost Assembly—In addition to housing the entire motor assembly, compressor and return spring (see cutaway view), this hollow one-piece ZINC Die Casting has cored openings and cast projections to simplify assembly of all other operating components.

High Strength—A drill head comes in for a lot of abuse in its everyday usage and the inherent *toughness* of the ZINC Die Cast housing assures trouble-free performance of this machine tool under such conditions.

For many other instances of successful product engineering with ZINC Die Castings ask us—or any die casting company—for a copy of "The End Uses of Zinc Die Castings."

Send for your copy

The New Jersey Zinc Company
160 Front St., New York 38, N. Y.

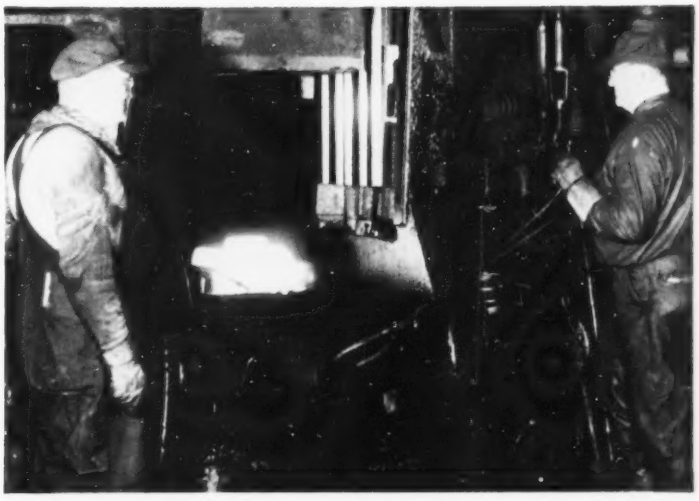
ZINC
FOR DIE CASTING ALLOYS

The Research was done, the Alloys were developed, and most Die Castings are based on
HORSE HEAD SPECIAL (99.99+% Uniform Quality) ZINC

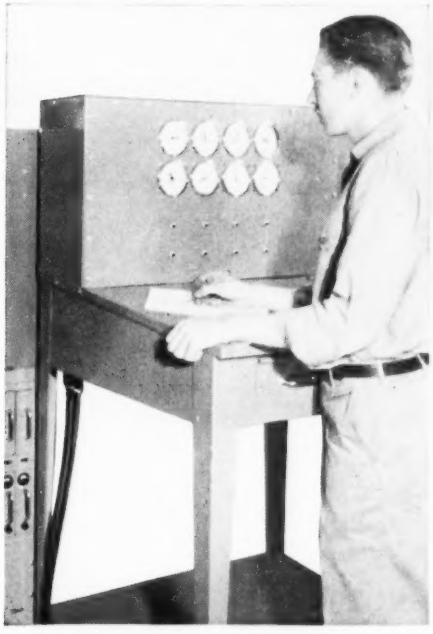
For more information on products advertised, use Inquiry Card, page 265

Why TIMKEN® forging steels give you uniform, high quality forgings

THIS MICROSCOPIC CHECK of your order makes sure that Timken® forging steels have uniform grain size after heat treatment. Result: higher ductility, higher impact. This is another example of the many ways the Timken Company controls quality at every step in production.



INDIVIDUAL HANDLING of your order enables us to target conditioning procedure to your forging requirements. Your forging rejects are minimized. And you save steel because the good dimensional tolerances of Timken bars produce uniform weight multiples with a minimum of steel lost in flashings.



RIGIDLY CONTROLLED CHEMISTRY assures you of uniform composition in every forging bar. This spectrometer, for example, tells the exact composition of a melt in just 40 seconds. Results are flashed back to the furnace so the melter can maintain constant control of the heat analysis.

YOU HAVE FEWER FURNACE ADJUSTMENTS when you use Timken forging steels. Every lot responds uniformly to heat treatment because every lot has the same physical and chemical properties. Always specify Timken forging steels. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD — THROUGH EXPERIENCE AND RESEARCH

TIMKEN
Fine Alloy
STEEL

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

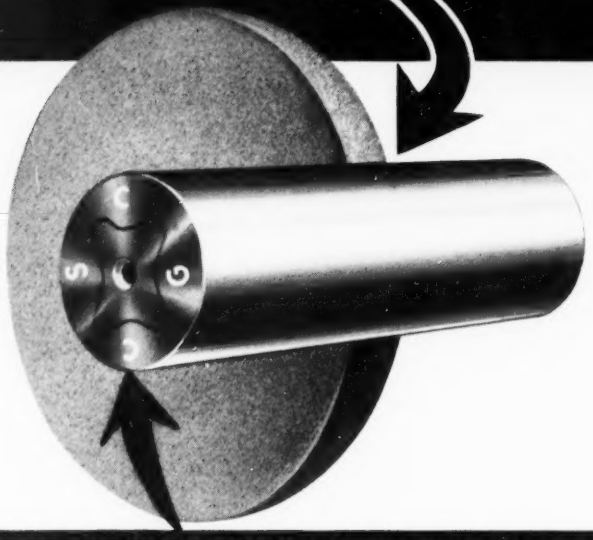
An exclusive GRINDING PROCESS...

makes

CUMBERLAND STEEL BARS

concentric, straight,

smooth & *really* accurate



BE SURE OF THIS MARK ON THE END OF YOUR SHAFTS

CUMBERLAND GROUND BARS FOR ALL TYPES OF MACHINES

They are carefully ground to our standard manufacturing tolerance, plus nothing to minus .002" on diameters 1-1/8" to 2-7/16" inclusive . . . plus nothing to minus .003" on diameters 2-1/2" to 8" inclusive. Closer tolerance can be furnished, if desired. And, remember, Cumberland Steel Shafts are the end result of 109 years' experience,—and every shaft is *carefully tested* before shipment. The list of Cumberland's customers reads like the "Blue Book" of Industry. Ask for further information.

MANUFACTURED IN THREE SPECIFICATIONS

Cumberland Brand—AISI C-1020/C-1025, Elastic Limit 30,000# Min.
Potomac Brand—AISI C-1040, Elastic Limit 45,000# Min.
Cumsco Brand—AISI C-1141, Elastic Limit 57,000# Min.

CUMBERLAND STEEL COMPANY

CUMBERLAND, MARYLAND, U.S.A

ESTABLISHED 1845 **INCORPORATED 1892**

For more information on products advertised, use Inquiry Card, page 265

intricately machined MAX-EL alloy steel part shows minimum distortion after heat treatment...

Halliburton Oil Well Cementing Company, Duncan, Oklahoma, selected hot rolled MAX-EL 3½ bar stock for the valve shown. It's an important part of their 5⅞" tester, used to sample fluids or gases during drilling operations, sometimes 15,000 to 20,000 feet below the surface.

The valve is machined in the annealed condition and then heat-treated. Even though it varies considerably in thickness, no distortion problems are encountered in this MAX-EL part.

Try MAX-EL in your shop. You'll like its better machinability, freedom from distortion and over-all quality. And you'll get longer tool life . . . more pieces per grind. Call Crucible for immediate warehouse delivery of MAX-EL steels.

CRUCIBLE first name in special purpose steels

54 years of Fine steelmaking **ALLOY STEELS**

CRUCIBLE STEEL COMPANY OF AMERICA, GENERAL SALES OFFICES, OLIVER BUILDING, PITTSBURGH, PA.

Branch Offices and Warehouses: ATLANTA • BALTIMORE • BOSTON • BUFFALO • CHARLOTTE • CHICAGO • CINCINNATI • CLEVELAND • DAYTON DENVER • DETROIT • HOUSTON • INDIANAPOLIS • LOS ANGELES • MILWAUKEE • NEWARK • NEW HAVEN • NEW YORK • PHILADELPHIA • PITTSBURGH PROVIDENCE • ROCKFORD • SAN FRANCISCO • SEATTLE • SPRINGFIELD, MASS. • ST. LOUIS • ST. PAUL • SYRACUSE • TORONTO, ONT. • WASHINGTON, D. C.

CUTTING. New S.E.C.O. keeps parts and tools cooler. Tools last longer, require fewer grindings; production is increased; finishes are uniformly good.

Now Better Than Ever!

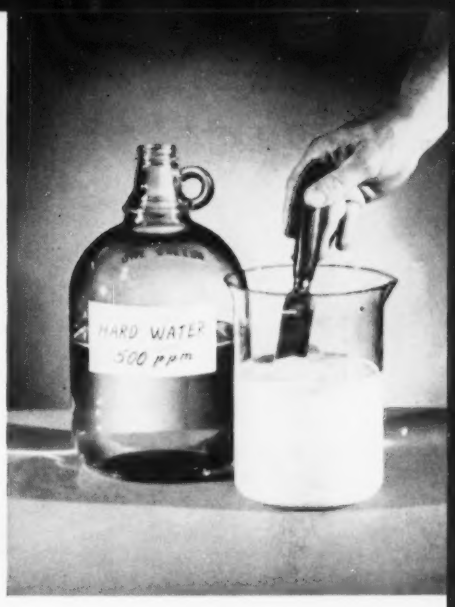
Sunoco Emulsifying Cutting Oil

New refining facilities improve industry's most widely used cutting oil and permit it to give these added benefits

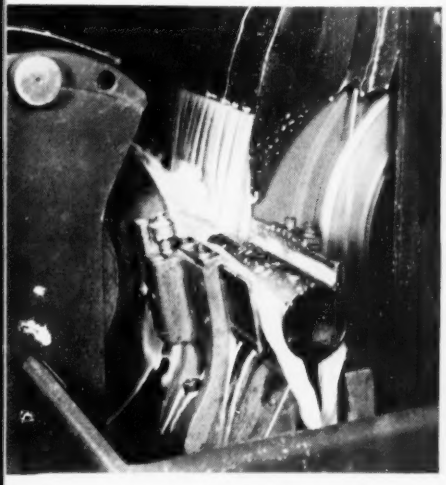
- **HIGHER MACHINING EFFICIENCY**—better finishes, longer tool life, increased production in cutting operations
- **INCREASED DETERGENCY**—particularly important in grinding operations—provides better surface finishes, prevents loading and glazing of the wheel, prolongs wheel life
- **BETTER MIXING QUALITIES**—in hot, cold or hard water
- **A PURER, CLEANER CUTTING OIL**—whiter, more stable emulsions; cleaner parts and machines; better operator acceptance
- **EASIER HANDLING**—pumps from storage tanks more readily, flows from drums faster
- **GREATER VERSATILITY**—can be used for rolling, washing and rustproofing as well as cutting and grinding

MIXES BETTER IN HOT WATER. New S.E.C.O. mixes and remains stable even at 180 F. This permits its use in washing and rustproofing.

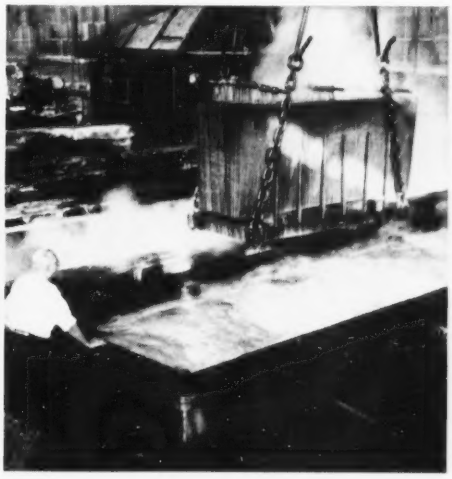
MIXES EASILY IN COLD WATER. New S.E.C.O. forms stable emulsions in the coldest water . . . even ice water does not affect it.



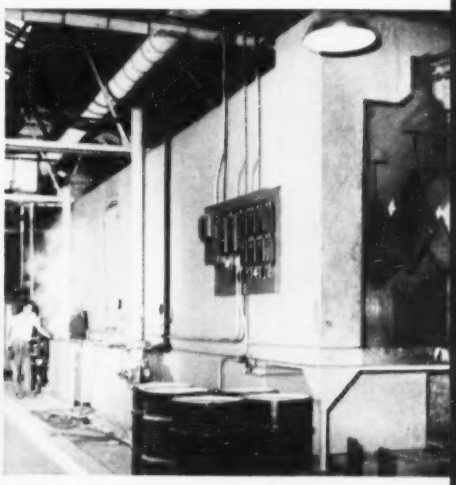
MIXES READILY IN HARD WATER. New S.E.C.O. eliminates the need for special hard-water grades of emulsifying cutting oil.



GRINDING. New S.E.C.O. improves surface finishes because its increased detergency prevents loading and glazing of grinding wheels, prolongs wheel life.



RUSTPROOFING. New S.E.C.O. is a better hot rustproofing medium. It forms stable emulsions, coats metal parts uniformly, protects them against rusting.



WASHING. Because of its increased detergency and its ability to mix and remain stable in hot water, New S.E.C.O. is better for removing grease and dirt from metals.

TEST THIS NEW S.E.C.O. IN YOUR OWN PLANT. For more information, call your nearest Sun office or write SUN OIL COMPANY, Phila. 3, Pa., Dept. M-7.

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY

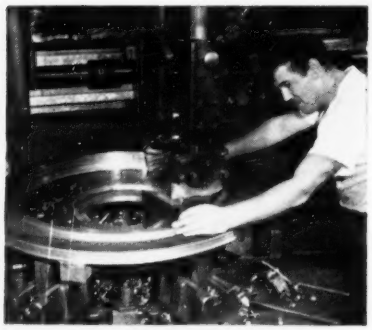
SUNOCO

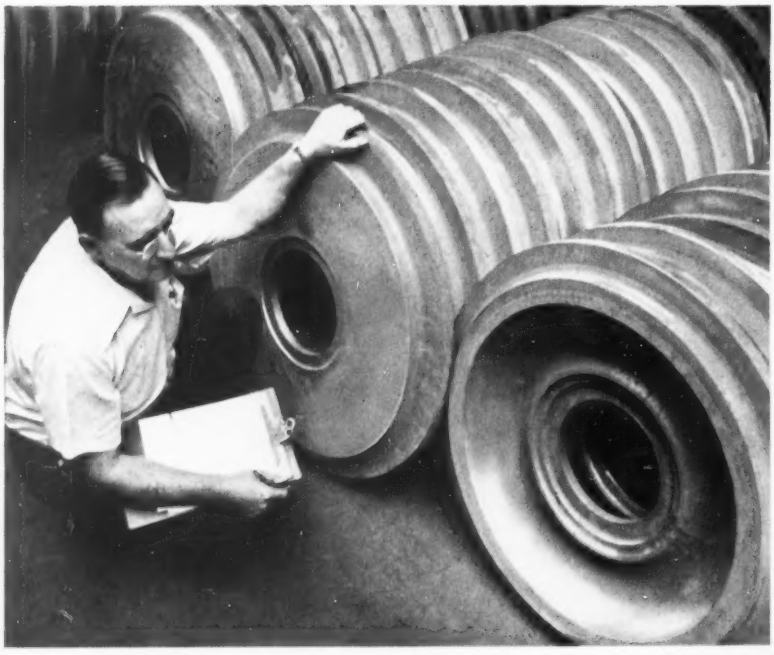
PHILADELPHIA 3, PA. • SUN OIL COMPANY LTD., TORONTO & MONTREAL

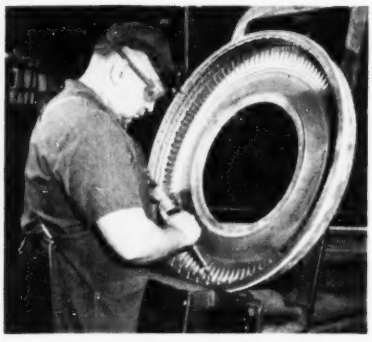
Made by the producers of famous Blue Sunoco Gasoline and Dynalube Motor Oils

For more information on products advertised, use Inquiry Card, page 265

THESE FORGED BLANKS *HELP REDUCE* MACHINING PROBLEMS







Checking a shipment of Bethlehem blanks at a plant of United States Rubber Company. Other photos show various stages in the machining of tire molds.

Steel with good grain flow, homogeneity, and uniform density can be machined with confidence. These characteristics are always present in Bethlehem's forged-and-rolled circular blanks, and they are one reason why this type of blank is so excellent for many applications.

Boiled down, reports from machine shops indicate the following:

When Bethlehem blanks are used, cutting speed is frequently higher, and fewer finishing cuts are required in many cases. Uniform finish allowance on OD, bore, and faces further contributes to speed and ease of machining. Moreover, the soundness of these blanks is an outstanding advantage.

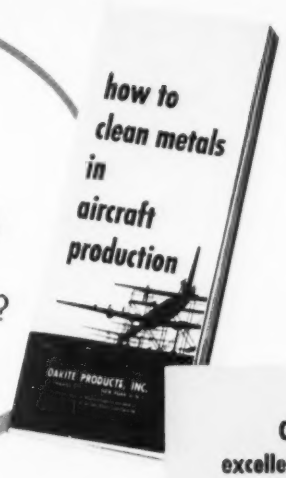
These strong steel blanks are ideal for gears, crane and sheave wheels, tire molds, flywheels, and a host of other circular parts. They are available untreated or heat-treated in sizes from 10 to 42 in. OD. Why not ask for full details?

BETHLEHEM
Forged-and-Rolled
CIRCULAR
FORGINGS

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

WHAT IS YOUR TOUGHEST CLEANING JOB IN AIRCRAFT PRODUCTION?



¶ **That's** hard to answer, isn't it? Maybe it's hard to remove smut from one alloy, no problem with other alloys. One drawing compound may harden into all kinds of trouble; others may wash away in a wink. ¶ **But,** whether it's an oxide or a weld flux or a stencil mark or a synthetic enamel that gives you a headache today, your Oakite Technical Service Representative is pretty sure to be able to help you laugh it off tomorrow. ¶ **Several** of our customers helped us make a list of jobs on which we could give them the most help. The table at the right shows these jobs in order of volume rather than toughness. There is some overlapping in the listings and some of the jobs – like machining, grinding, forming and preventing corrosion – are not strictly cleaning jobs. But every one is a job for which we have a material or a method that may be worth a lot of money to you. ¶ **You** may not agree with the ranking of these jobs. But a glance at the list may stimulate your ideas about improving some of your operations. If you'll circle in the coupon the numbers of the jobs that interest you, we'll be glad to tell you about Oakite materials designed for your work.

FREE Our 48-page illustrated booklet *"How to Clean Metals in Aircraft Production"* contains information on all the cleaning jobs in the list.

Oakite has excellent materials for all these jobs:

1. **Cleaning aluminum**
2. **Stripping paint with solvent strippers**
3. **Stripping paint from steel (hot tank)**
4. **Machining and grinding**
5. **Deoxidizing aluminum**
6. **Steam cleaning aluminum**
7. **Steam cleaning steel**
8. **Deflocculating paint in spray booths**
9. **Metal forming**
10. **Stripping paint from aluminum (hot tank)**
11. **Removing corrosion and preparing for painting**
12. **Descaling**
13. **Preventing corrosion**
14. **Cleaning magnesium**
15. **Electrocleaning steel**
16. **Barrel finishing**
17. **Plant maintenance cleaning and sanitizing**

OAKITE PRODUCTS, INC., 26 Rector St., New York 6, N. Y.

Send me a FREE copy of your booklet *"How to Clean Metals in Aircraft Production."*
I especially wish to obtain better results in the jobs indicated by the numbers circled below:

1 2 3 4 5 6 7 8 9
10 11 12 13 14 15 16 17

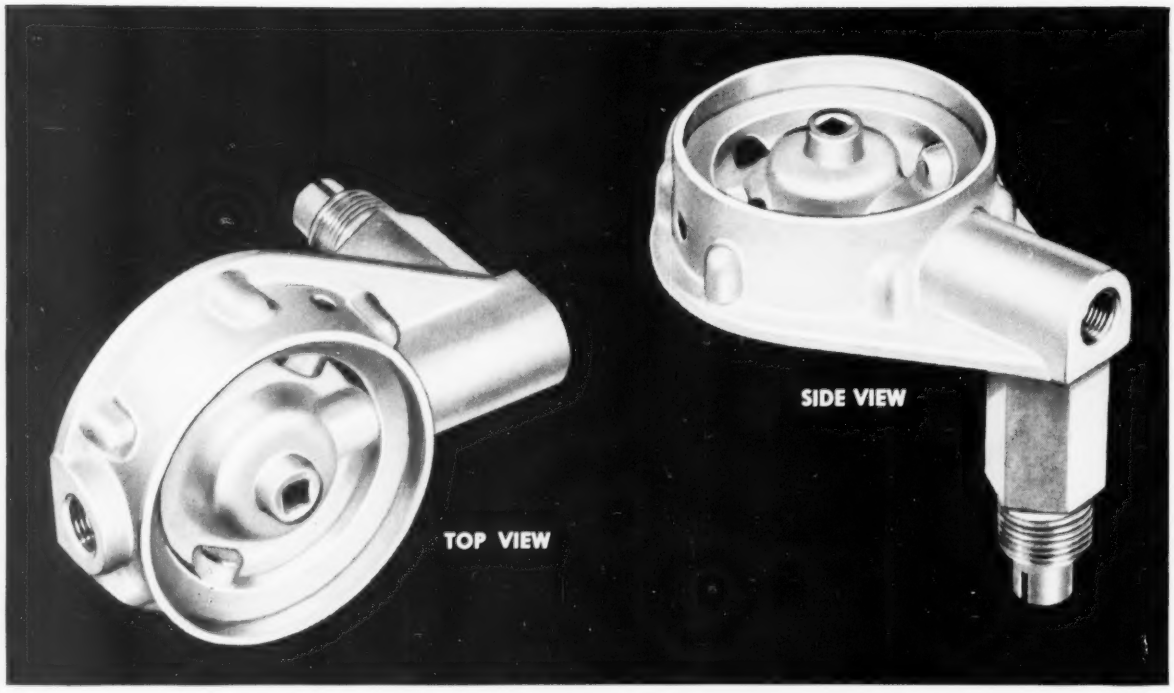
NAME_____

COMPANY_____

ADDRESS_____

SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS • METHODS • SERVICE

Technical Service Representatives in Principal Cities of U. S. and Canada



profitable designing with MADISON-KIPP zinc and aluminum die castings

Co-ordinated effort by the part designer and Madison-Kipp produced this Fuel Filter Body which required no machining except tapping and threading. This procedure has often proved highly profitable.

Madison-Kipp has seasoned and skilled mechanics who know that many manufacturing problems can be resolved or at least reduced on the drafting board.

If you think we can be helpful to you, please write us.

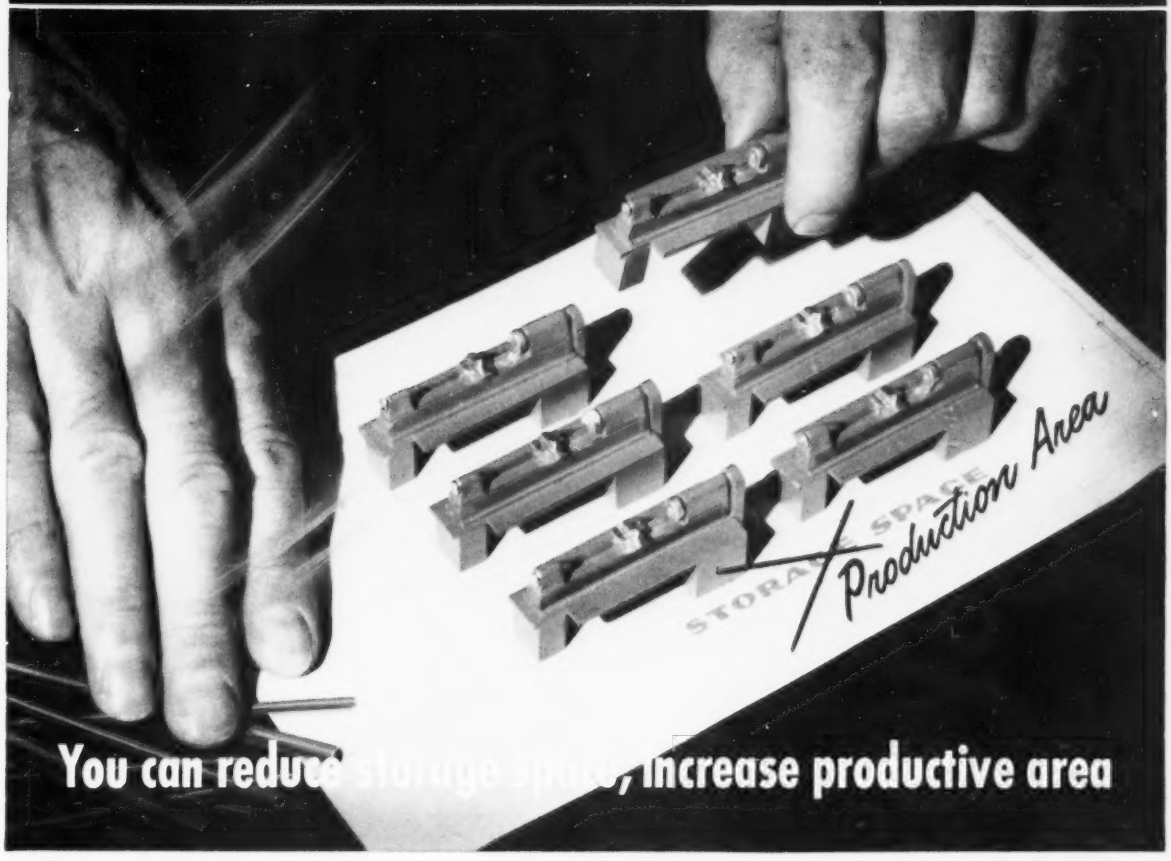
kipp

MADISON-KIPP CORPORATION
203 WAUBESA ST., MADISON 10, WISCONSIN, U. S. A.

• Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

For more information on products advertised, use Inquiry Card, page 265

WHY IT PAYS TO BUY MECHANICAL TUBING FROM US



● There's no need of sacrificing large areas of valuable floor space for tubing storage when those areas *could* easily be made productive. Why not let *us* carry the storage and handling costs?

Our warehouses stock an exceptionally large variety of tubing products . . . in fact, no less than 531 sizes of Shelby Seamless Mechanical Tubing are readily available! So you can always count on quick delivery of exactly the type and size tubing you need . . . whether your order is by the inch or by the carload. And all our tubing products are made by the world's leading manufacturer of fine tubing and pipe —National Tube Division of U. S. Steel.

And, our extensive experience with tubing problems has often led to customer savings. For in many cases, our engineers can suggest a more economical type of tubing for your application.

Contact our nearest warehouse the next time you need quality tubing of any sort and in any quantity from our stock or directly from the mill: mechanical tubing, round and square, seamless and welded; boiler tubing, pressure tubing and pipe; and stainless steel tubing and pipe, seamless and welded.

TRIPLE SECURITY

What you want
When you want it
At the **right price**

U. S. STEEL SUPPLY
DIVISION

General Offices
208 So. La Salle St., Chicago 4, Ill.

USS

Warehouses and Sales Offices
Coast to Coast

USS STEEL
UNITED STATES STEEL

UNITED STATES STEEL

2 Stainless Parts...*look alike*

but with 1 of them

A grinding operation is eliminated

Finish and accuracy to size are vital in fabricating this hinge pivot pin. When the Company used ordinary Type 303 Stainless, machined finish was poor and parts had to be ground before delivery. Then they made just one change . . . to Carpenter Stainless No. 8 (Type 303). Now finish is fine, size tolerances so close that final grinding is eliminated.

Part cost reduced 50%

When the change was made to Carpenter No. 8, things started to happen. All troubles previously encountered—including troubles with finish, tools and production, were cleared up. In fact, production has improved to a point that the Company makes an estimated saving of at least 50%. That's a saving worth having—especially when it can be done so easily.

Tool runs between grinds jump 100% to 200%

Before this shop switched to Carpenter Stainless, tools had to be reground every 8 hours or less. Now, they run 18 to 24 hours between grinds. It all adds up to more proof that the difference in stainless steels is Carpenter quality and uniformity. You can see the difference in speed, quality and profit in your own shop—when you specify "Carpenter" on your next stainless order.

Make the <u>one</u> change that counts . . .

change to *Carpenter* STEEL — **Free-Machining Stainless**

take the problems out of production

THE CARPENTER STEEL COMPANY, 105 W. Bern St., Reading, Pa.
Export Department: The Carpenter Steel Co., Port Washington, N.Y.—"CARSTEELCO"

For fast delivery, call your nearest Carpenter Mill-Branch Warehouse, Office or Distributor

Master Machinist's DREAM COME TRUE!

First and only truly dual-purpose lathe, with features never offered together before...the Monarch 13″ model EE precision lathe

It's a toolmaker's lathe—and it sets new standards in high work output. It's a manufacturing lathe—slashing turning time with toolroom accuracy and finish. It will do any turning job within its capacity better and faster, as a look at the partial list of features will assure you. It offers flexibility unlimited with *complete* control concentrated at the apron—66 thread and feed changes—full accessory complement as regular equipment. It's built for the utmost in ruggedness, ease, accuracy and speed. Write for our Booklet #502 with the complete 13″ Model EE Lathe story.

THE MONARCH MACHINE TOOL COMPANY, Sidney, Ohio

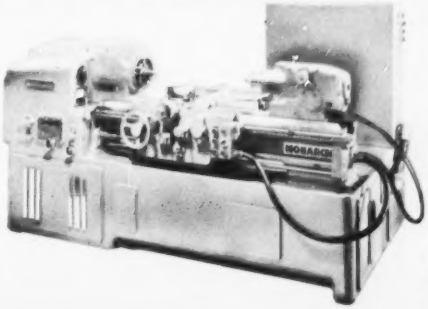
Monarch makes a 10″ Model EE, too. Turn the page for details.

You Get All This in the Monarch 13″ Model EE

1. Built-in constant surface cutting speed. Most efficient cutting speed, always—improves accuracy and finish—reduces some facing times up to 50%.

2. Infinitely variable speeds up to 2000 R.P.M. With 15 H.P. variable speed motor delivering 4 overlapping ranges, number of speeds is limitless. High speed range direct to spindle thru multiple "V" belts.

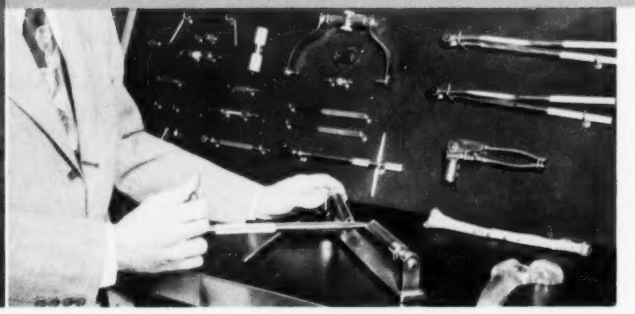
3. Electric speed change. Practically instantaneous. Accomplished from operator's normal position at apron. No calculating of lever settings by reference to an index plate is needed.



4. Four-way rapid tool traverse. Cross and longitudinal movements are provided by individual motor drive. Cuts tool adjust time 50%.

5. Unique hydraulic tailstock. Hydraulic positioning and clamping at the touch of a button. Hydraulic feed and traverse to spindle. Easiest drilling and reaming you ever saw!

Just What the Doctor Orders!



Example of sensitivity and precision without equal... from the Monarch 10" model EE toolmaker's lathe

Doctors' orders are especially exact when it comes to these delicate but powerful, precision bone surgery instruments. To satisfy them, you need the finest machining equipment on the market.

Above you see a turning operation in the shop of Dallas R. Trinkle and Sons, famed orthopaedic engineers *and* master machinists. The part being turned by Perry Trinkle is, of course, of surgical steel. The machine is our 10" Model EE Sensitive Precision Toolmaker's Lathe—a machine on which the Trinkles rely exclusively, because of its deft exactness in turning, boring and facing; its unlimited versatility; and because it has already given them over 40,000 hours of dependable, trouble-free service.

Perhaps your turning requirements aren't this refined. Still—wouldn't this kind of accuracy, speed and sensitivity help your production too? Let us send you our Booklet #302 giving complete information about our 10" Model EE. Just write . . .

THE MONARCH MACHINE TOOL COMPANY, Sidney, Ohio

Turn to preceding page for report on the companion 13" Model EE Precision Lathe.

Monarch

ACCURACY • ECONOMY • LONG LIFE

TURNING MACHINES

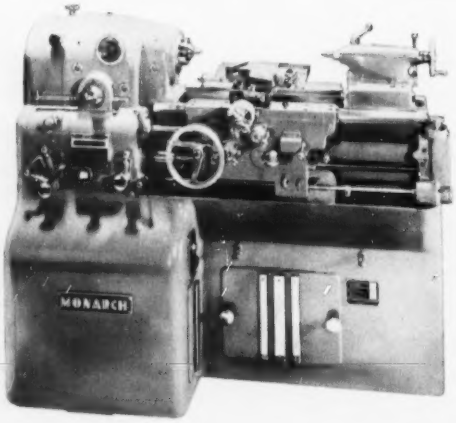
FOR A GOOD TURN FASTER—TURN TO MONARCH

Monarch 10" Model EE features

A true high speed lathe for small work. Available with speed ranges up to 40 to 4000 R.P.M.

All electric drive direct to spindle through multiple "V" belts. No gears in headstock.

For thread chasing up to 100% faster, has exclusive combination of electric lead-screw reverse and variable reverse speed control.



The only small lathe available with anti-friction bearing taper attachment.

Easy, fatigue-free operation. Base design lets operator work close in comfort. He gets production—not backaches.

Totally enclosed, automatically lubricated end gearing and gear box.

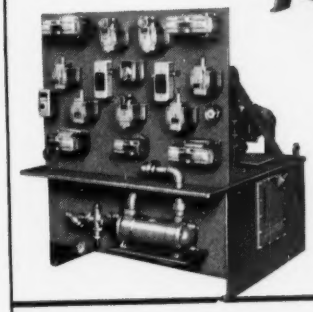
Flame hardened and ground ways for both carriage and tailstock. Bed all in one piece—no inserts.

American Standard Camlock spindle nose—3" Type D-1.

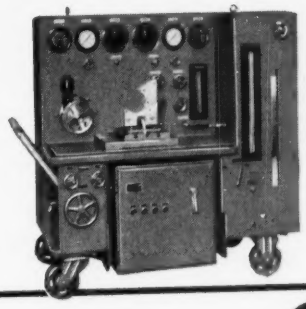
Over 6000 10" Model EE machines in use today.

The 10" Model EE—sensitive and exact as a great surgeon's hands—versatile as the venerable country doctor. Manufacturing and Toolmaker's models. With Monarch Air-Gage Tracer, they become high-output production machines noted for speed, accuracy and high finish.

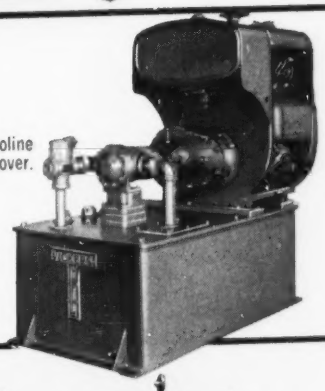
Pulpit type power unit provides full visibility, easy accessibility.



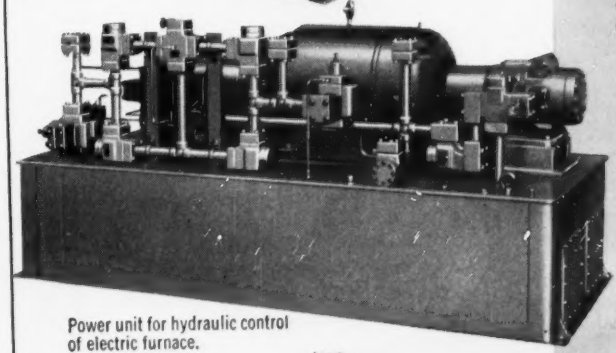
Compact power unit showing gasket-mounted valves.



Portable power unit for testing pumps.



Power unit with gasoline engine as prime mover.



Power unit for hydraulic control of electric furnace.

6837

Individually Designed to Meet *SPECIFIC* Needs

VICKERS®

Custom Built

HYDRAULIC POWER UNITS

DEPENDABLE PERFORMANCE

IMPROVE AND SIMPLIFY DESIGN

REDUCE INSTALLATION COST AND TIME

EASIER SERVICING

BETTER APPEARANCE

Vickers engineers approach the design of a custom-built hydraulic power unit from the standpoint of the customer's INDIVIDUAL needs. The sole objective is to meet HIS requirements with the best hydraulic "package". This assures the most compact, efficient and convenient hydraulic equipment for the particular machine.

A Vickers Hydraulic Power Unit includes all necessary pumps, valves, intermediate piping, oil reservoir, motors, controls, etc., as well as all hydraulic accessories (oil filters, air cleaners, oil level gauges, fittings, etc.). Hydraulic connections can be grouped in a convenient manifold.

In addition to the advantages mentioned above, each Unit is pretested at the factory and ready for immediate operation. Vickers undivided responsibility for the entire hydraulic control system is also an important feature to both the machine builder and his customer. Write for Bulletin 52-45.

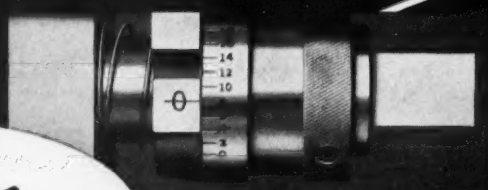
VICKERS Incorporated

DIVISION OF THE SPERRY CORPORATION

1400 OAKMAN BLVD. • DETROIT 32, MICH.

Application Engineering Offices: **• ATLANTA • CHICAGO AREA (Brookfield) • CINCINNATI • CLEVELAND • DETROIT • HOUSTON LOS ANGELES AREA (El Segundo) • NEW YORK AREA (Summit, N.J.) PHILADELPHIA AREA (Media) • PITTSBURGH AREA (Mt. Lebanon) ROCHESTER • ROCKFORD • SAN FRANCISCO AREA (Berkeley) SEATTLE • TULSA • WASHINGTON • WORCESTER**

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921



blade clearance indicator

. . . precise adjustment, easily and quickly made by the operator, gives correct blade clearance for any gauge or type of metal, minimizes burrs and greatly prolongs blade life.

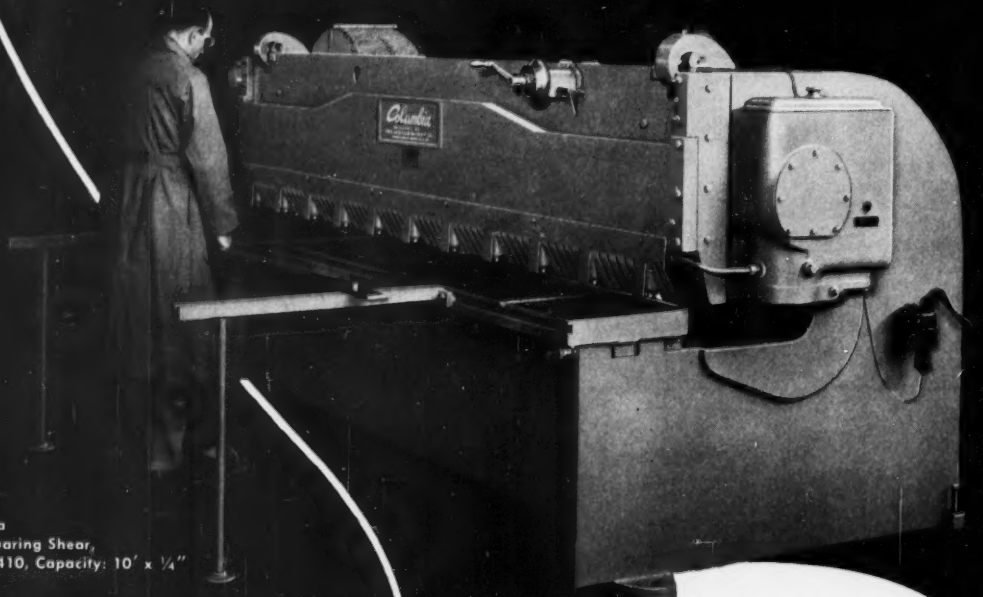
another **Columbia** shear feature

quick-set blade clearance adjustment

Columbia "New Series" steel squaring shears have many features specifically designed and refined to give low-cost, trouble-free operation.

The Blade Clearance Indicator, for example, lets the *operator* adjust blade clearance quickly and easily. This feature eliminates waiting for supervisory personnel, gives burr-free shearing on any gauge metal and significantly increases blade life.

Other Columbia features you should know about include the exclusive air clutch, hydraulic hold-downs, jog control for ram and others. Combine these with basic rigidity, rugged mechanism and long-lasting accuracy and you have the answer to low-cost shearing . . . the Columbia "New Series" Shear.



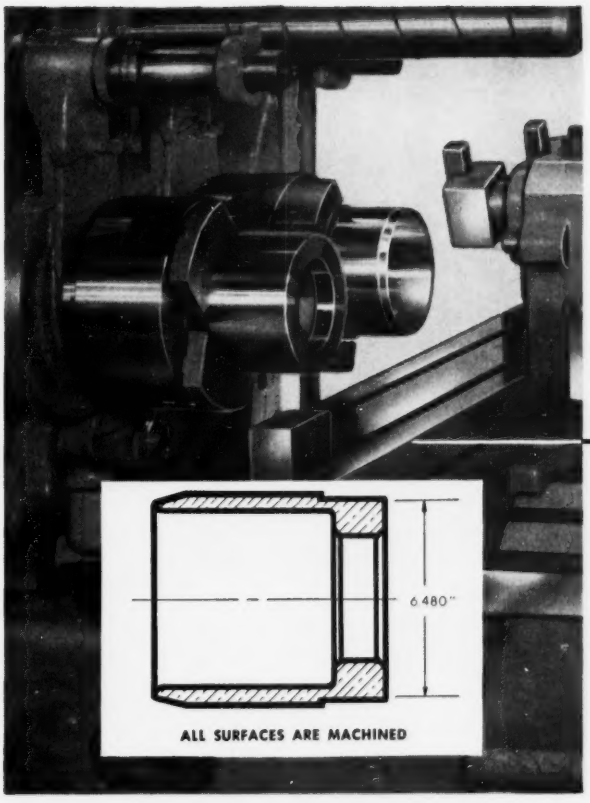
Columbia
Steel Squaring Shear,
Model 0410, Capacity: 10' x ¼"

Other exclusive Columbia features are explained in detail in FREE Bulletin No. PS-1. Write for it and the name of your Columbia distributor today!

Columbia Division, The Lodge & Shipley Co.
Hamilton 1, Ohio

new series **Columbia** STEEL SQUARING SHEARS and POWER PRESS BRAKES

For more information on products advertised, use Inquiry Card, page 265



TWO-SPINDLE *Automatic Turret Lathe* DOUBLES PRODUCTION

THIS BRONZE CASTING COMPLETELY FINISHED

. . . in one turret cycle

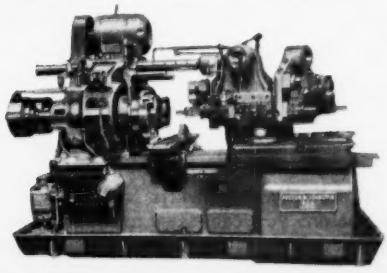
. . . in 4.48 minutes

(FLOOR-TO-FLOOR TIME)

WITH A

5D-2 POWER-FLEX Automatic Turret Lathe plus P & J Tooling

To get more production per unit of floor area, consider the P&J 2-Spindle Automatic Turret Lathe. With double spindles driven from a common power source, this machine far exceeds the output of any single-spindle type for work within its range. And you'll cut costs *FOUR WAYS*. One P&J 2-Spindle Machine uses far less power . . . costs far less initially . . . takes half the floor space . . . and is easier to operate.



Consider also features of the 5D-2 POWER-FLEX common to all P&J turning machines — automatic chucking, automatic speed and feed changes — ample power, rigidity and flexibility — time-proved construction that assures accuracy and long life, more return from your original investment.

See for yourself how the 5D-2 POWER-FLEX can bring greater profits to your plant. Send today for your copy of Bulletin 123 — or ask P&J Engineers to submit tooling recommendations based on your own prints or sample parts.

MODERNIZE with POTTER & JOHNSTON REPLACE FOR PROFIT

WRITE DIRECT OR CONTACT YOUR NEAREST PRATT & WHITNEY BRANCH OFFICE

BIRMINGHAM • BOSTON • CHICAGO • CINCINNATI • CLEVELAND • DETROIT • LOS ANGELES • NEW YORK • PHILADELPHIA • PITTSBURGH • ROCHESTER • SAN FRANCISCO • ST. LOUIS • EXPORT DEPT., PAWTUCKET, RHODE ISLAND

AGENTS: DALLAS, THE STANCO CO. HOUSTON, WESSENDORFF, NELMS & CO.

POTTER & JOHNSTON CO.

PAWTUCKET, RHODE ISLAND

SUBSIDIARY OF

PRATT & WHITNEY

DIVISION NILES – BEMENT – POND COMPANY

P&J

PRECISION PRODUCTION TOOLING FOR OVER FIFTY YEARS

VERSATILITY

..a big word at LANCASTER MALLEABLES

Another on-the-spot photo of a KRW Hydraulic Press in action

only KRW gives you all this!

- **HEAVY CONSTRUCTION THROUGHOUT** — Bed and crown members are truss-reinforced for added stiffness and strength. A KRW exclusive feature.
- **SELECT YOUR PRESSURE** — Required tonnage pressure up to rated capacity can be quickly obtained and locked for repetitive operations.
- **ONE SWINGING BALL ARM** — Controls downward motion of ram, holds pressure on work, or returns ram.
- **ACCURATE "INCHING" OF RAM** — Motor runs only when ball arm is moved for downward ram travel.
- **SPRING RETURN OF RAM** — Gives maximum speed on upstroke.
- **HIGHEST QUALITY** — Radial type Hydraulic pump.
- **DIRECT CONNECTED** — Motor drive through flexible coupling.
- **TWO SPEED HAND PUMP** — Also furnished on motor driven presses in this series.

. . . so they chose the most versatile press they could find!

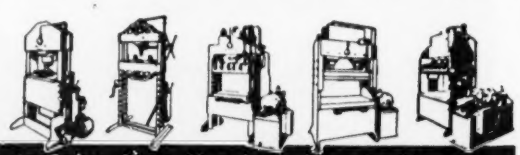
Lancaster Malleables & Steel Co. makes so many different castings for so many different companies that their choice of a Hydraulic Press for straightening work was a mighty important one. They might have a run of locomotive brake ends, parts for pneumatic tools, automobile jacks, and rear end tractor housings all in one day and they needed a press that could keep pace. We showed them how fast a KRW motor-driven Hydraulic Press converts from one set-up to another — almost before you can say Lancaster Malleables and Steel Co. — and they were sold. Lancaster officials tell us this press is adding to its reputation for speed, accuracy and versatility every day.

WRITE FOR FACTS

You too will save time and cut costs with a KRW Hydraulic Press. Note carefully the features at the left. You get them only from KRW. We make a full line of one, two and three cylinder Hydraulic Presses; 25-150 ton capacities; hand, air or motor driven. Check with your Machinery dealer or write us for full facts and prices.

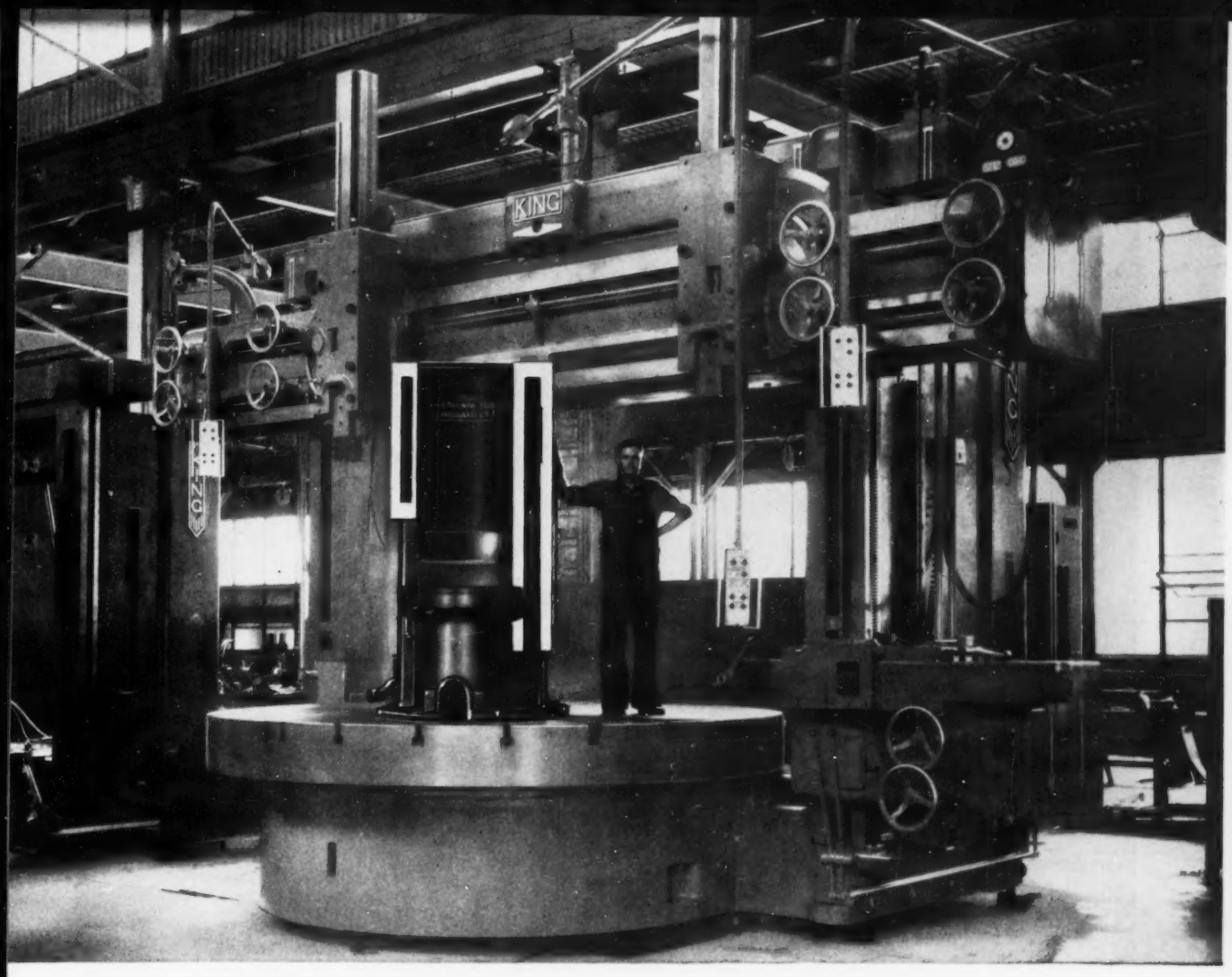
K·R·WILSON

213 Mill Street, Arcade, N. Y.



Designers and Builders of the Right Hydraulic Press to Solve Your Metal-working Problems!

For more information on products advertised, use Inquiry Card, page 265



Meet "both ends" of the KING size range

30" to 144"

VERTICAL BORING & TURNING MACHINES

Pictured above, on the table of a massive 144" KING® Vertical Boring & Turning Machine, is the base and column of a rugged 30" KING . . . the "big" and "little" of the KING size range. KING and *only* KING "covers the field" with ten sizes: 30" and 36", one head on rail—42", 52", 62", 72", 84", 100", 120" and 144", one or two heads on rail. All size KINGS are available in a variety of head combinations, with or without side head.

KING'S wide size range lets you select the *right* size machine to fit *your* boring, facing, and turning requirements. These extra-heavy, extra-rigid machines have the speed, power, ease of control, and dependable accuracy that are essential for turning out your work with maximum efficiency in minimum time. See your KING distributor—or write us direct—for complete information on the many outstanding features of KING machines.

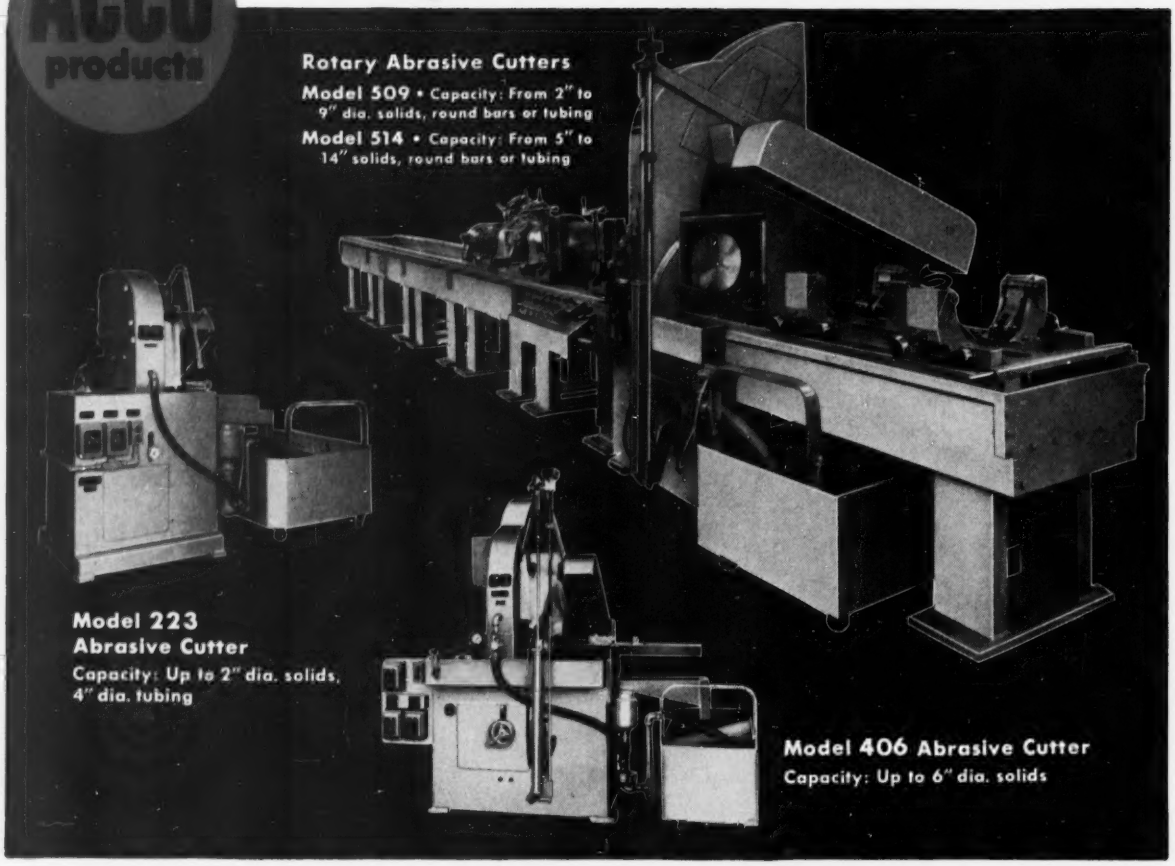
AMERICAN STEEL FOUNDRIES

KING MACHINE TOOL DIVISION

Vertical boring & turning machines . . . 1150 TENNESSEE AVE., CINCINNATI 29, OHIO

Campbell Abrasive Cutters

ACCO products


Rotary Abrasive Cutters
Model 509 • Capacity: From 2" to 9" dia. solids, round bars or tubing
Model 514 • Capacity: From 5" to 14" solids, round bars or tubing
Model 223 Abrasive Cutter
Capacity: Up to 2" dia. solids, 4" dia. tubing
Model 406 Abrasive Cutter
Capacity: Up to 6" dia. solids

Quick cut-offs save you money—here's how . . .

By rapidly cutting stock that takes much longer by other cutting methods, CAMPBELL Abrasive Cutters reduce your labor costs and the number of machines required. They make quality cuts on alloy and high carbon steels. Close tolerances, smooth finish and straight cuts can be made, resulting in large savings of material. Cuts all types of stock without hardening and with minimum of burr.

It will pay you to remember these CAMPBELL features:

1. Superior Sales Engineering Service
CAMPBELL engineers, experienced in every type of cutting problem, are available for consultation on YOUR cutting problems.

2. Economy and Speed of Operation
CAMPBELL Abrasive Cutters are built to do every type of cutting job with the utmost accuracy, efficiency and economy. Cuts are smooth and practically burr free.

3. Complete Line of Standard Machines
CAMPBELL Abrasive Cutters are available in the widest variety of styles and models. They are fully automatic and semi-automatic. Have many exclusive features.

• • •

Consultation with trained CAMPBELL engineers will cost you nothing. Let them show you how the addition, or substitution, of the right abrasive cutter can increase your output per man-hour. It could be the most profitable move you ever made.

Write today for Bulletin DH-301 on Campbell Abrasive Cutting Method

ACCO

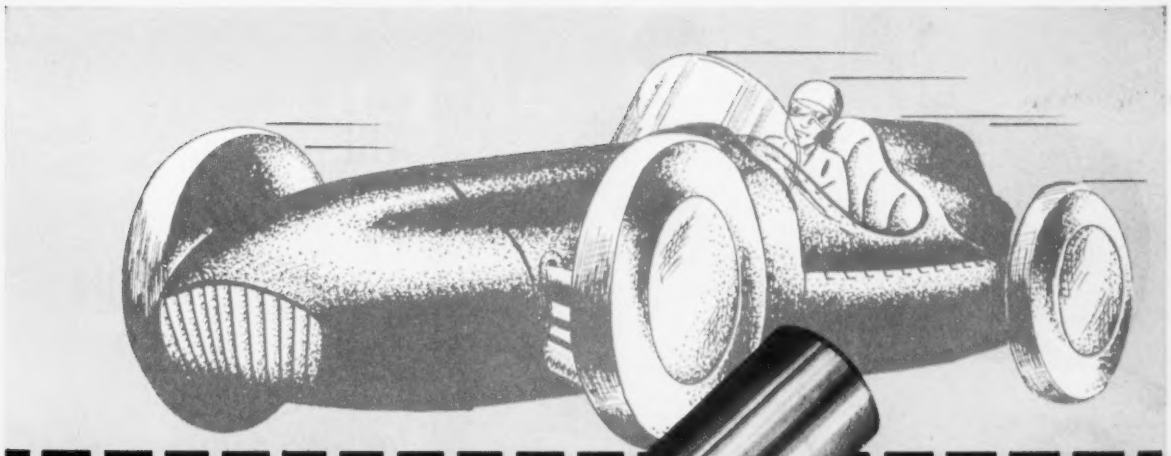
TRADE MARK

Campbell Machine Division
AMERICAN CHAIN & CABLE

925 Connecticut Avenue, Bridgeport 2, Connecticut

Wet and Dry Cutters and Nibblers

For more information on products advertised, use Inquiry Card, page 265



R and L TAP AND DIE HOLDER

WHEN SECONDS COUNT

The R and L TAP AND DIE HOLDER readily changes from right to left due to the patented instant release action. It can also be adapted to work on short threads, do bottom tapping, or die up to shoulders.

Releasing or non-releasing, (also furnished for acorn dies), this tool is made in a complete range of sizes from ⅝" diameter shank to 1½" diameter shank.

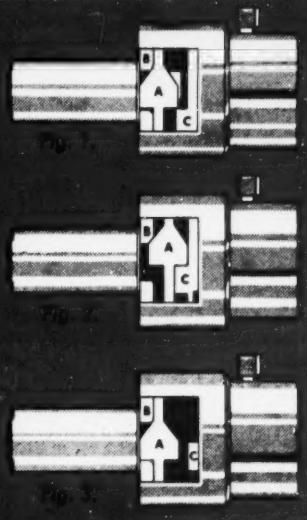


Fig. 1. Ready to start threading operation.

Fig. 2. Instantly engaged to full contact.

Fig. 3. Fully released. Note ample clearance between contact points of clutch.

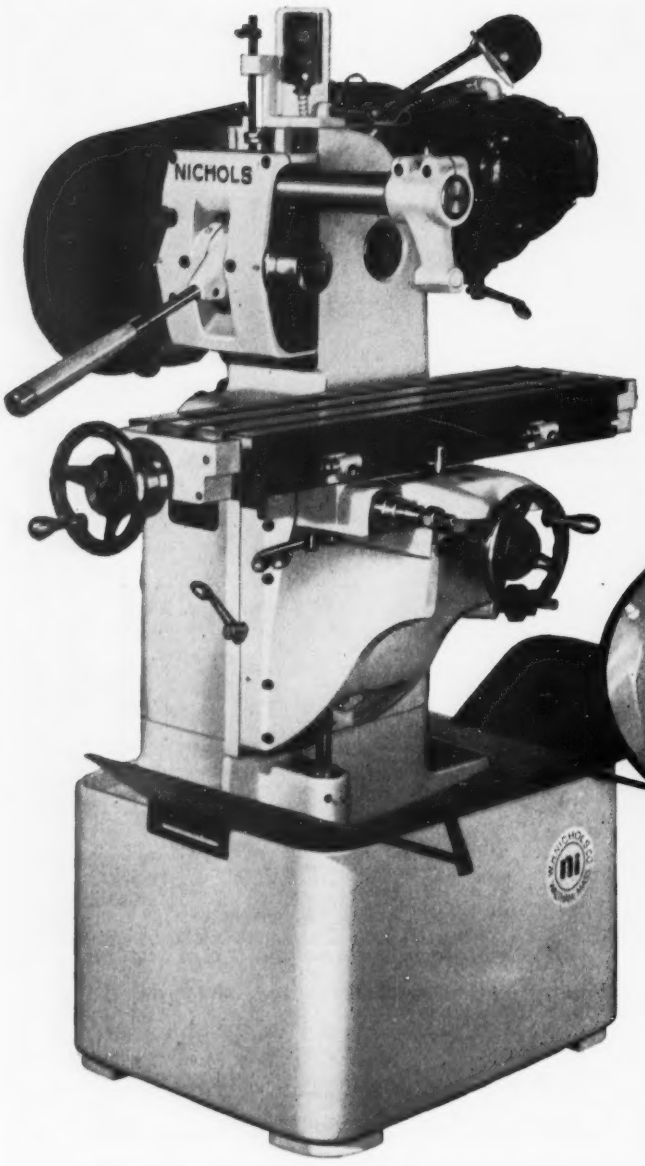
Write for Catalog

R and L TOOLS

RIGHT LEFT

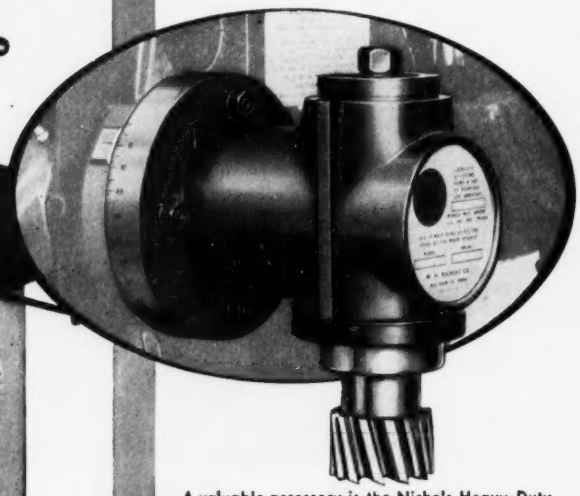
1825 BRISTOL STREET • PHILADELPHIA 40, PA.

TURNING TOOL • CARBIDE OR ROLLER BACKRESTS • RELEASING OR NON-RELEASING TAP AND DIE HOLDERS, (ALSO AVAILABLE FOR ACORN DIES) • UNIVERSAL TOOL POST • TURRET BACKREST HOLDER • CUT-OFF BLADE HOLDER • RECESSING TOOL • REVOLVING STOCK STOP • FLOATING DRILL HOLDER • KNURLING TOOL



THE *Nichols* TOOL ROOM MILLER

"the miller that uses its head!"



A valuable accessory is the Nichols Heavy-Duty Vertical Milling Attachment. Takes full 1½ H. P. up to 2000 R. P. M. (So precise, some shops use it for jig boring!)

The unusual versatility and extra capacity of this model make it extremely useful for the tool room. Because it is equipped with the "rise-and-fall" spindle, it can perform not only conventional precision milling, but also facing boring, key seating, contour milling and other operations. Both longitudinal and transverse feed screws are fitted with hand wheels and extra-large adjustable micrometer dials with easy-to-read graduations. This model is especially useful because of its compactness, generous capacity and ability to handle a wide variety of work to close tolerances —to *"tenths" when desired!*

CONDENSED SPECIFICATIONS

Table Working Surface	8½" x 30"
Longitudinal Travel	19"
Transverse Travel	7"
Vertical Travel—Knee	13½"
Rise and Fall of Spindle	4½"
Selective Speed Ranges up to 5000 R. P. M.	
Weight	1250 lbs.

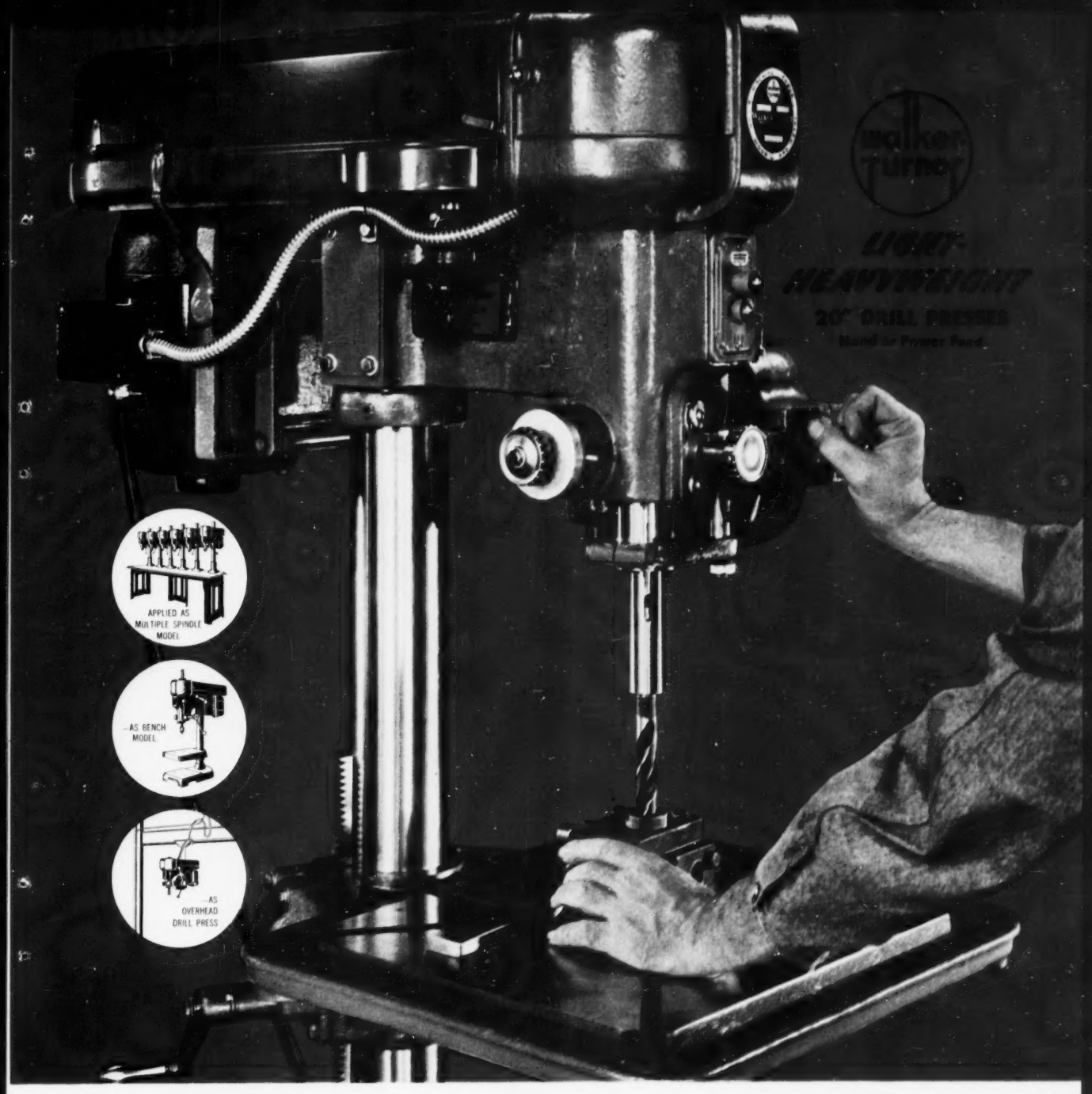
Write today for Nichols general catalog which describes the six models of Nichols Millers. A sound, color movie, "the Miller that Uses its Head" is available for free showing. May we reserve it for you?

MANUFACTURED BY W. H. NICHOLS COMPANY • WALTHAM, MASSACHUSETTS

NATIONAL DISTRIBUTORS **NICHOLS-MORRIS CORPORATION**

76-E MAMARONECK AVE. WHITE PLAINS, N. Y.

For more information on products advertised, use Inquiry Card, page 265



LIGHT-HEAVYWEIGHT Performance Wins New Recognition

The word is getting around about the past performance of Walker-Turner LIGHT-HEAVYWEIGHTS. A newly completed check of leading industries reveals this pertinent fact: *of the 250 largest manufacturers, no less than 93% right now are Walker-Turner users.*

They find in LIGHT-HEAVYWEIGHTS the features and engineering usually available only in large and costly equipment. Take this Walker-Turner 20" Drill Press, for example. It has a heavy, one-piece cast iron head; a 10-spline spindle 1" in diameter; and 4 heavy-duty, precision ball bearings—to name just a few of its fine features that make for top quality...at far from top price.

There's much more to this Walker-Turner LIGHT-HEAVYWEIGHT story that our factory-trained Distributor in your area would like to tell you. You'll find him an expert on industrial equipment, a good man to know. And he's as near as your phone. So why not call him, or write us for his name and more information—today!

WALKER-TURNER

• DIVISION •

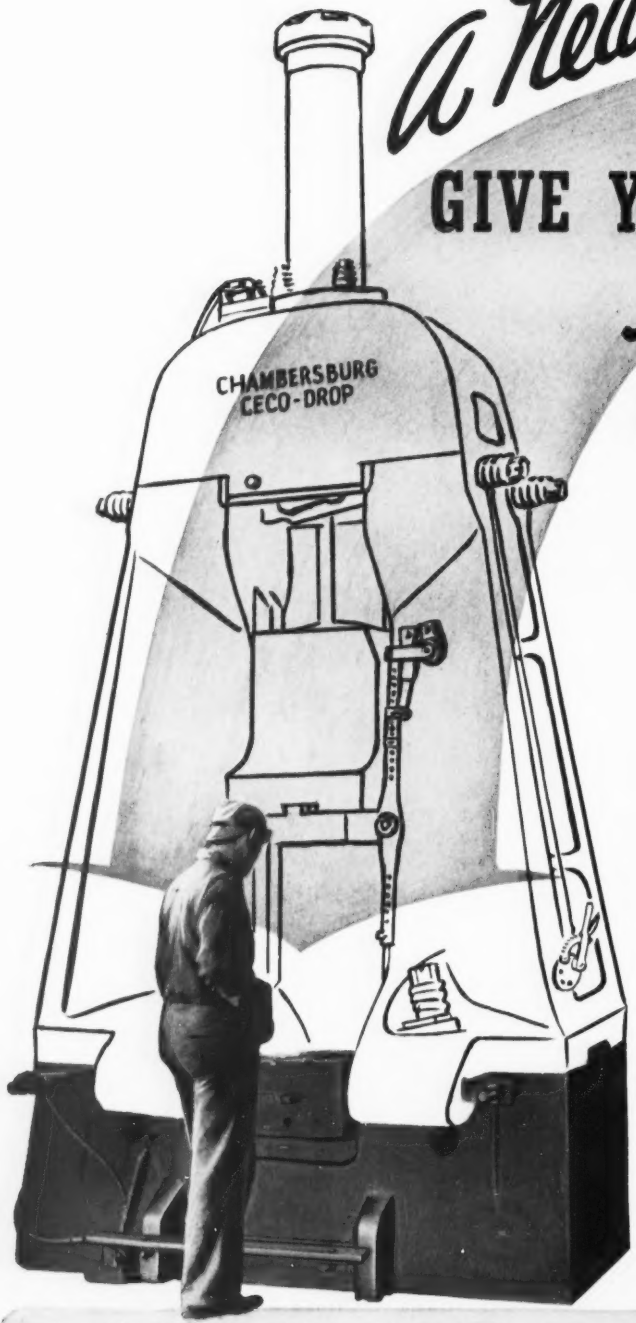
KEARNEY AND TRECKER CORPORATION

PLAINFIELD, N. J.

DRILL PRESSES — Hand and Power Feed • RADIAL DRILLS Wood and Metal Cutting BAND SAWS • TILTING ARBOR SAWS RADIAL SAWS • JIG SAWS • LATHES • SPINDLE SHAPERS • JOINTERS BELT AND DISC SURFACERS • FLEXIBLE SHAFT MACHINES

GIVE YOUR BOARD DROP HAMMERS *a New lift!*

GIVE YOUR OPERATORS *New life!*



YOUR PRESENT ANVILS PLUS CECO-DROP UPPERWORKS

can mean quick modernization at a minimum cost and can put new life in your operators

Here's a good suggestion: You can install Ceco-Drop upperworks on your existing board drop hammer anvils. Thus at a considerable saving you will be in a position to meet and beat tomorrow's stiff competition. You will produce more accurate forgings at a lower cost through more continuous production. You will have the most modern forging hammers available. Your hammermen will end their shifts fresh and still full of pep.

That's part of the Ceco-Drop story. The rest is in Bulletin 57-L-4 a copy of which will be sent on request. Write today.

CHAMBERSBURG ENGINEERING CO., CHAMBERSBURG, PA.

CHAMBERSBURG

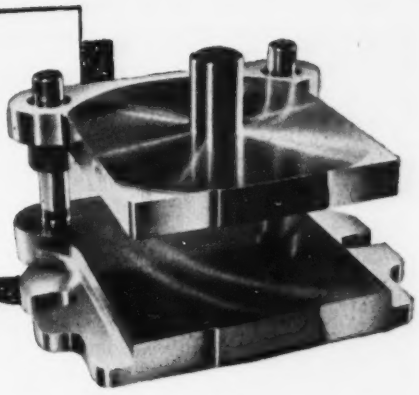
THE HAMMER BUILDERS

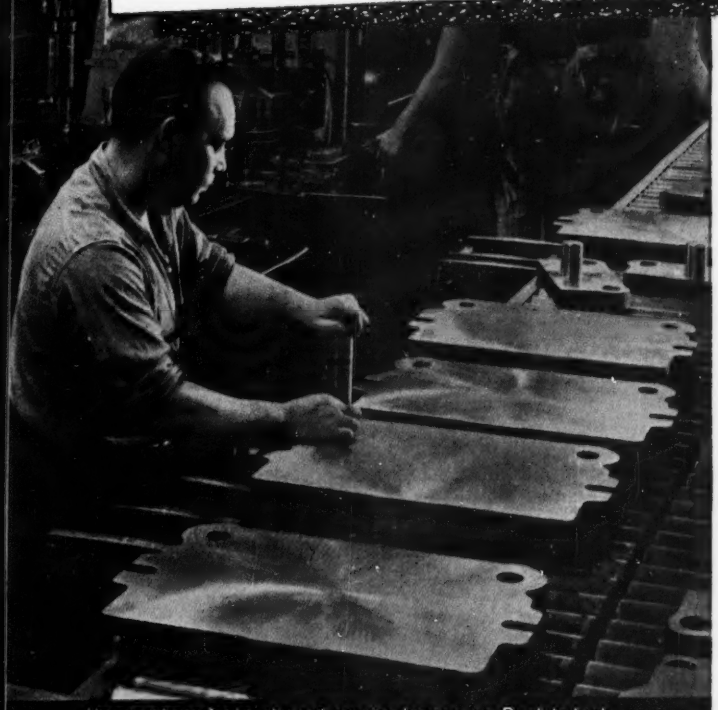
Builders of **THE IMPACTER**

"FORGING IN MID-AIR"

For more information on products advertised, use Inquiry Card, page 265

World's fastest die set service in action





Here's where faster die set service begins, on Danly's high speed precision production lines . . . the finest mass production facilities in the die set field.

Here's where your order is received . . . in one of Danly's Branch Plants. Because all die components are close at hand, your order is filled immediately.

Now—Danly unites mass production techniques with the precision touch of craftsmanship to bring you the fastest die set service . . . ever.

Never before has there been a die set service as fast as the one that Danly now offers to you. Unique in concept, the system had its beginning some years ago when Danly originated its network of nationwide Danly Branches. Under such a system the main Danly Plant in Chicago provided thousands of *interchangeable* die set parts to Danly Branch Plants. It meant that such parts were easily assembled into standard die sets and then quickly delivered to meet the requirements of any tooling program.

But, as buyers recognized the convenience of Danly service, demands on the Chicago Plant grew to exceed capacity. The solution? . . . an unprecedented move in the die set field. Danly put die set manufacture on a mass production basis with no sacrifice of famous Danly precision. It was accomplished with amazing new facilities in the form of two complete production lines devoted exclusively to high speed, precision die set production. The next time you put one or a dozen Danly Die Sets on order, expect to get fast delivery from any Danly Branch, expect to get die sets unequaled in precision. You can expect it and you'll get it . . . when it's Danly.

DANLY®

DIE SETS . . . STANDARD OR SPECIAL
DIEMAKERS' SUPPLIES

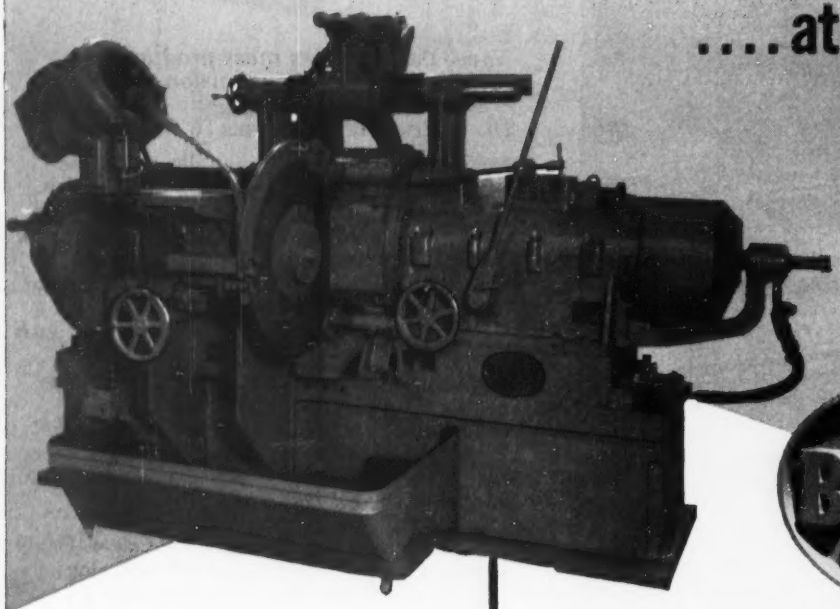
Fast, nationwide delivery from these plants

***CHICAGO** 50	2100 S. Laramie Avenue
***CLEVELAND** 14	1550 East 33rd Street
***DAYTON** 7	3196 Delphos Avenue
***DETROIT** 16	1549 Temple Avenue
***GRAND RAPIDS**	113 Michigan Street, N.W.
INDIANAPOLIS 4	5 West 10th Street
***LONG ISLAND CITY** 1	47-28 37th Street
***LOS ANGELES** 54	Ducommun Metals & Supply Co., 4890 South Alameda
MILWAUKEE 2	111 E. Wisconsin Avenue
***PHILADELPHIA** 40	511 W. Courtland Street
***ROCHESTER** 6	33 Rutter Street

**Indicates complete stock.*

ACCURACY HELD Within .0002"

for ① SIZE ② FLATNESS ③ PARALLELISM



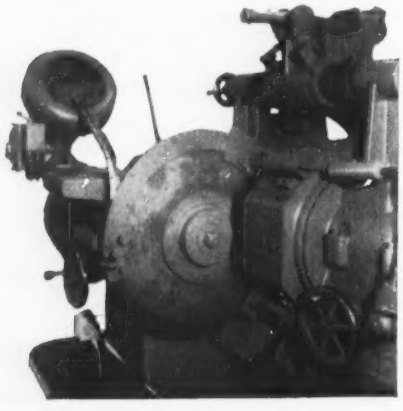
....at 750 Pieces Per Hour

with this

BESLY

AUTOMATIC FEEDING Gives Precision at Production Rates

Hydraulic pump vanes are automatically hopper fed into a constantly rotating feed wheel, which has a series of openings to receive parts. As the feed wheel revolves, the pump vanes are carried between the parallel faces of the abrasive discs where two sides of the vanes are simultaneously ground. After grinding, the parts are automatically unloaded into a discharge pan.



No. 226 Double Spindle Wet Disc GRINDER

High speed steel pump vanes which are used in the hydraulic pump of an automotive power steering unit are finish ground with this precision grinder . . . and at a rate of 750 pieces or 1500 surfaces an hour. Precision at production rates can be yours, too, because Besly Double Spindle Wet Disc Grinders can be easily adapted to grind many other parallel surfaced parts. Write for full information.

BESLY

BESLY-WELLES CORPORATION

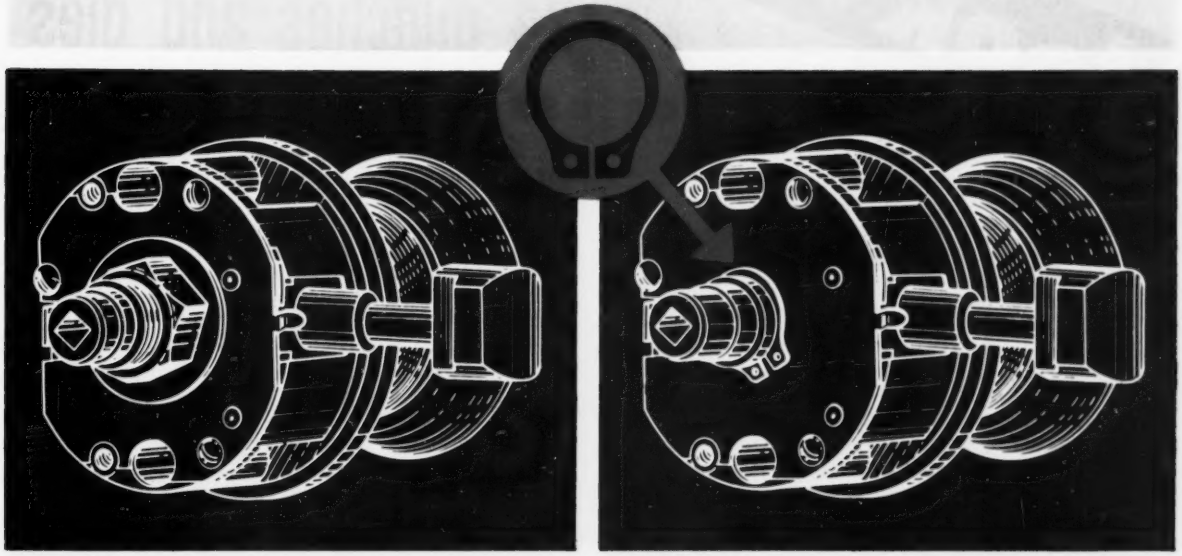
Established as Charles H. Besly & Company in 1875

112 Dearborn Ave., Beloit, Wisconsin

BESLY GRINDERS AND ACCESSORIES • BESLY TAPS, DRILLS, REAMERS • BESLY-TITAN ABRASIVE WHEELS

For more information on products advertised, use Inquiry Card, page 265

Waldes Truarc Ring Replaces Nut and Washer ...Cuts Costs $5.28 Per M...Speeds Assembly by 50%



OLD WAY. Main shaft required costly threading. Assembly was slowed by the double application of washer and nut and time-consuming tightening operation.

TRUARC WAY. Truarc Retaining Ring snaps quickly and simply over shaft. Lock assembly is secured in one fast operation. Virtually all play is eliminated from lock.

NEW DESIGN USING WALDES TRUARC RING PERMITTED THESE SAVINGS

OLD WAY

Cost of Nut	$10.00	*per thousand*
Cost of Washer	3.80	" "
Labor for Threading	2.00	" "
Assembly	3.00	" "
TOTAL	**$18.80**	

TRUARC WAY

Cost of Truarc Ring and Grooving Operation	$11.52	*per thousand*
Assembly	2.00	" "
TOTAL	**$13.52**	

J. Chesler and Sons, Inc., Brooklyn, N.Y., manufacturers of the pre-assembled "Reddi-Mount" cylindrical lockset, uses a single Waldes Truarc Retaining Ring instead of an old fashioned nut and washer to secure the entire assembly of their lock. This new, improved fastening method enables Chesler to eliminate costly threading . . . save money on material . . . speed assembly time by 50% and produce an improved, more durable product.

You, too, can save money with Truarc Rings. Wherever you use machined shoulders, bolts, snap rings, cotter pins, there's a Waldes Truarc Retaining Ring designed to do a better, more economical job. Waldes Truarc Rings are precision-engineered . . . quick and easy to assemble and disassemble.

Find out what Waldes Truarc Retaining Rings can do for you. Send your blueprints to Waldes Truarc engineers.

For precision internal grooving and undercutting... Waldes Truarc Grooving Tool

SEND FOR NEW CATALOG

WALDES

TRUARC

REG. U. S. PAT. OFF.

RETAINING RINGS

WALDES KOHINOOR, INC., LONG ISLAND CITY 1, NEW YORK

WALDES TRUARC RETAINING RINGS AND PLIERS ARE PROTECTED BY ONE OR MORE OF THE FOLLOWING U. S. PATENTS: 2,382,947; 2,382,948; 2,416,852; 2,428,341; 2,439,785; 2,441,846; 2,455,165; 2,420,941; 2,483,380; 2,483,383; 2,487,802; 2,487,803; 2,491,306; 2,509,081; AND OTHER PATENTS PENDING.

M076

Waldes Kohinoor, Inc., 47-16 Austel Pl., L. I. C. 1, N. Y.

Please send me the new Waldes Truarc Retaining Ring catalog.

(Please print)

Name.....

Title .....

Company .....

Business Address.....

City..... *Zone*..... *State*.....

look . . . any one of these 24 punches and dies

READY FOR USE IN 5 SECONDS

without set-up!

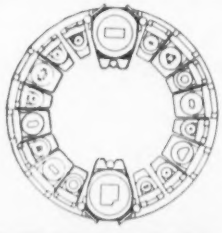
- Or, any selection of 12 to 32 punches and dies suited for your work.
- A Wiedemann Turret Punch Press has the tools where you want them—in the press—not on the shelf.
- In 5 seconds the operator selects the punch and die, and pierces the opening in flat sheet metal or plate.
- Any punch and die in the turret can be replaced with other sizes in less than 2 minutes.

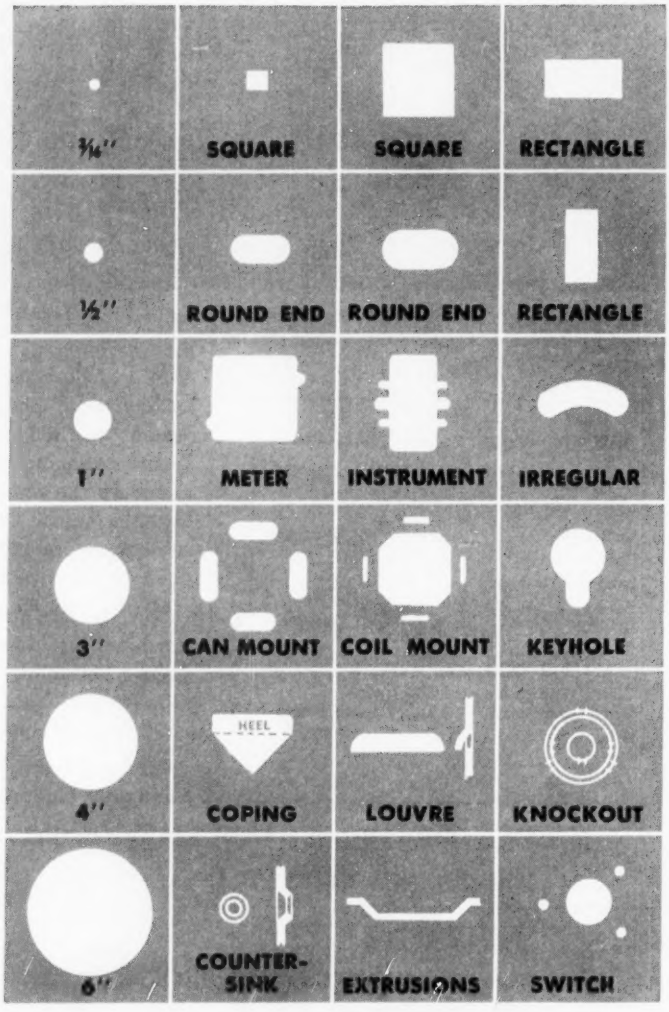
WITH A WIEDEMANN YOU CAN SAVE 60% TO 90% ON SMALL LOT PIERCING because you

Eliminate Set-up
Eliminate Layout with Wiedemann Work Locating Gauges
Reduce Handling Time

We will make time studies on your work without obligation. Send prints.

Plan view of lower turret of typical Wiedemann with 18 stations.





WIEDEMANN MACHINE COMPANY

4205 Wissahickon Ave., Philadelphia 32, Pa.

For more information on products advertised, use Inquiry Card, page 265

What size is a quality fastener?

Here are two ELASTIC STOP® nuts.
Each has the familiar red locking collar. Each is self-locking, vibration-proof and can be reused many times. Each is a fast, readily assembled one-piece unit . . . will maintain accurate adjustment anywhere on a bolt. Each will afford positive protection against thread corrosion . . . prevent liquid seepage along bolts. Each is manufactured in quantity. Each is exactly controlled as to quality of raw material, finished dimensions, class of thread fit, seat squareness and finish. Each has a record for precision and uniformly high performance that is unmatched.

But . . . one measures 1/10 inch across the flats; the other, 4 inches. Between these two, there are more than 530 different hex nuts in the ESNA line. They are the result of variations in height, material, finish and size.

Look to ESNA for the top quality self-locking fastener that fits your need best.

ELASTIC STOP NUT CORPORATION OF AMERICA

ESNA® TRADE MARK

ROLLPIN TRADEMARK

Elastic Stop Nut Corporation of America
Dept. N58-759, 2330 Vauxhall Road, Union, N. J.
Please send the following free fastening information:

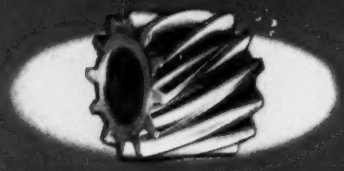
☐ ELASTIC STOP nut bulletin ☐ Here is a drawing of our product. What self-locking fastener would you suggest?

Name _____ Title _____
Firm _____
Street _____
City _____ Zone _____ State _____

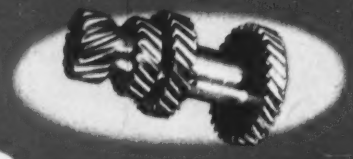
GEARS SHAVED in 12 to 20 SECONDS

Finishing precision gears to close tolerances on tooth profile, index, eccentricity and tooth surface smoothness on Red Ring Shaving Machines is a high production operation as indicated by these random examples.

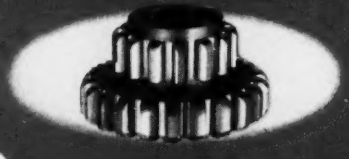
A SHAVING TIME 16 SECONDS



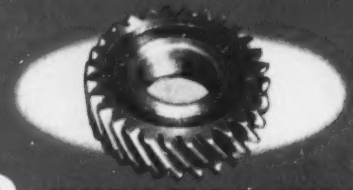
D SHAVING TIME 12 SECONDS



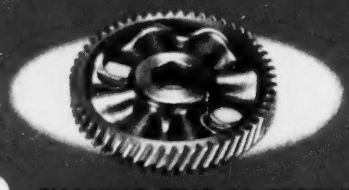
B SHAVING TIME 16 SECONDS



E SHAVING TIME 15 SECONDS



C SHAVING TIME 20 SECONDS



F SHAVING TIME 20 SECONDS

GEAR CHARACTERISTICS

Gear	Stock Removed Over Pins	Material	No. of Teeth	PD	DP	Face Width
A	.010"	Steel	19	2.4"	9.25	5/8"
B	.010"	Steel	29	4.00	9.25	11/16"
C	.010"	Cast Iron	28	2¾"	10	1⅛"
D	.005"	Steel	12	1⅛"	13.5	1"
E	.006"	Steel	14	2⅛"	6/8	11/16"
F	.012"	Aluminum	54	5⅞"	10	⅞"

WRITE FOR DESCRIPTIVE LITERATURE ON *Red Ring Gear Shaving*

SPUR AND HELICAL GEAR SPECIALISTS

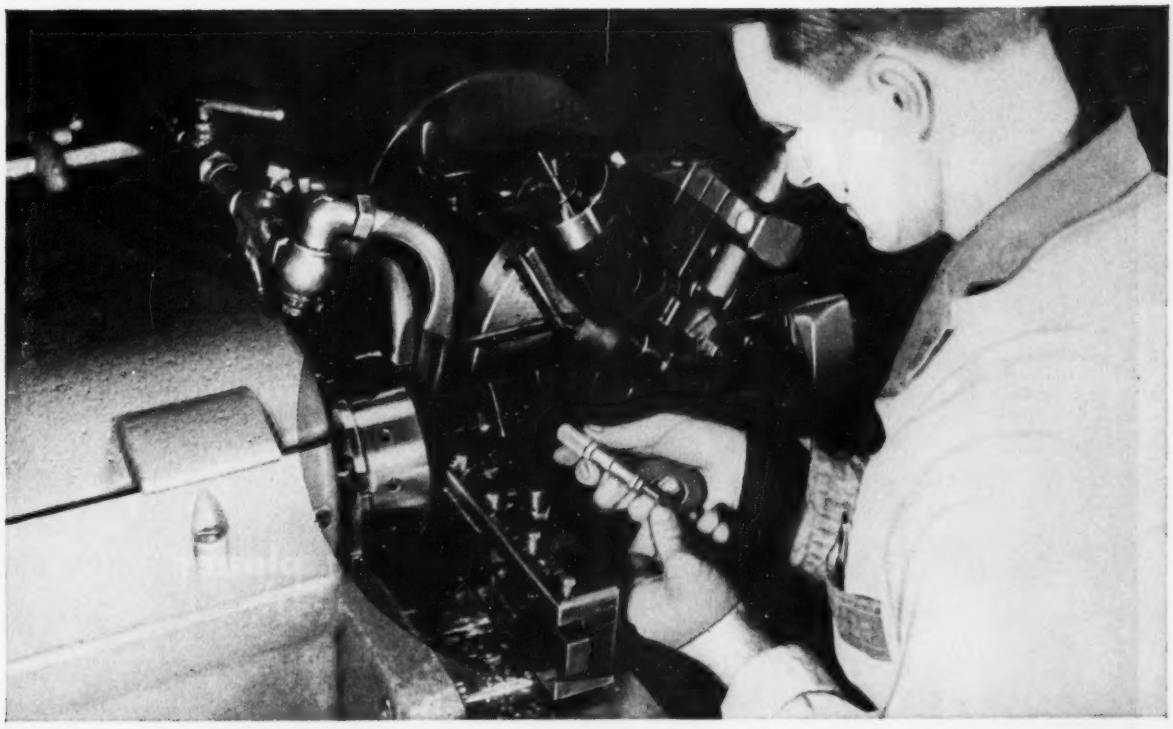
ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORM

NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN . . . . . DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

For more information on products advertised, use Inquiry Card, page 265



TOOL LIFE INCREASED 40% USING CITIES SERVICE CUTTING OIL

ONE OIL FOR ALL? After poor results with many cutting oils, the Dunbar Machine & Tool Company discovered all their cutting jobs could be done to perfection using only one oil . . . Cities Service Chillo #44.

NO EYE STRAIN. In addition to a 40% increase in tool life, owner Robert Dunbar found that the transparent characteristics of Chillo #44 help eliminate eye strain. Cutting operation is easily visible to operator.

Production Also Up, Reports Dunbar Machine & Tool Co.

THE PROBLEM . . . The Dunbar Machine & Tool Company had a problem. It seemed impossible to find one oil which would perform economically and efficiently for ALL the jobs required of the firm's automatic screw machines.

THE SOLUTION . . . After trying many brands of cutting oil, "none of which gave good all-round performance," owner Robert Dunbar called in a Cities Service engineer. After careful analysis of the problem, the engineer recommended Chillo #44 cutting oil.

THE RESULTS . . . Using Chillo #44, the company observed these results: Tool life increased nearly 40% . . . Production increased accordingly . . . Additional savings realized due to chip draining characteristics of oil . . . Holding tolerances no longer any problem . . . Machine clean-up time now insignificant . . . Transparency of oil eliminates eye-strain . . . Less smoke and fumes at high speeds . . . Also excellent for lubricating purposes. Says Mr. Dunbar, "Our results with Chillo #44 permit us to heartily endorse this product."

If you have a cutting oil problem, consult your nearest Cities Service representative or write Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

Monarch

Replaces a planer equipped with grinder head attachment

This Giant Thompson Grinder is one of nine working for The Monarch Machine Tool Company.

Through the years in increasing efficiency of their very fine lathes and in step with modern methods, Monarch has relied on the utility and precision of Thompson Grinders. Thompson is proud of this record of service and especially its ability to provide extreme precision grinding on this largest of all surface grinders.

INSTALLS WORLD'S LARGEST...

Surface Grinder

precision grinding lathe bedways up to 32 ft. long to a tolerance of five ten-thousandths of an inch .0005"

The precision of Thompson Way Grinders is exemplified in this giant new machine recently installed in the plant of the Monarch Machine Tool Company of Sidney, Ohio. Monarch lathes are known the world over for their extreme efficiency and accuracy, therefore, in the machining of the bedways of their longest machines they had to depend on grinding equipment that maintained exceptional accuracy over entire surfaces up to 32 feet in length. This accuracy is perfectly maintained on this Thompson Way Grinder to five ten-thousands of an inch.

Thus, this surface grinder is not only the World's largest but size for size, one of the World's most accurate machines. The overall length is 79 feet and it measures 13 feet high and 13½ feet wide. Yet in spite of its size all operations are easily controlled by a single operator automatically from the convenient suspended push button control panel. This is typical of Thompson centralized control available with all types and sizes of Thompson Grinders. It will pay you to consult Thompson Engineers in finding an economical solution to *your* problems.

Have Thompson Engineers solve your grinding problems

THE THOMPSON GRINDER COMPANY
Springfield, Ohio

Thompson Grinders

For more information on products advertised, use Inquiry Card, page 265

21,000 tons

of gentle, squeezing power in this

TRADE **Verson** MARK

Wheelon

Direct Acting

HYDRAULIC PRESS

The Verson-Wheelon Bulletin explains the simple operation of the Verson-Wheelon Press and shows examples of the work it performs. Typical specifications are also given. It is available on request.

Yes, this Verson-Wheelon Press has a capacity equivalent to a 21,000 ton rubber pad forming press. However, it does a better, more complete forming job than the rubber pad press; yet its cost is only a fraction of that of the conventional press.

The Verson-Wheelon Press illustrated operates at 5,000 psi. Its twin feeding tables are each 50″ x 168″ to handle long channels for a leading aircraft manufacturer.

If you are now doing or contemplating rubber pad forming, you should consider a Verson-Wheelon Press before you buy. Compare the price and compare the work—it's the best way to convince yourself of the economy of Verson-Wheelon forming. The bulletin described at the left gives full information. Write for your copy, today.

A Verson Press for every job from 60 tons up.

TRADE **Verson** MARK

ORIGINATORS AND PIONEERS OF ALLSTEEL STAMPING PRESS CONSTRUCTION

VERSON ALLSTEEL PRESS CO.

9309 S. KENWOOD AVENUE, CHICAGO 19, ILLINOIS • SO. LAMAR AT LEDBETTER DRIVE, DALLAS, TEXAS

MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES • TRANSMAT PRESSES • TOOLING • DIE CUSHIONS • VERSON-WHEELON HYDRAULIC PRESSES

For more information on products advertised, use Inquiry Card, page 265

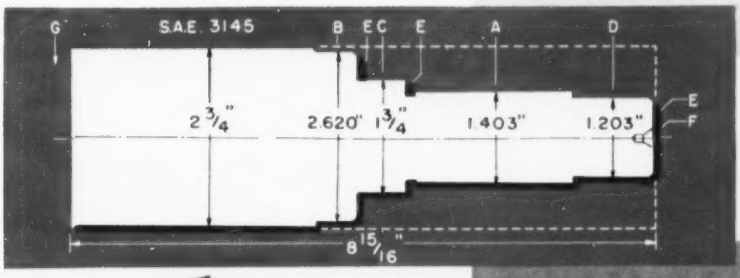
This is the difference High Velocity Turning makes

IN 1950 this job took...

12.40 min.

FLOOR TO FLOOR

A. Turn 489 RPM — .011 feed
B. Turn 340 RPM — .022 feed
C. Turn 489 RPM — .011 feed
D. Turn 489 RPM — .011 feed
E. Face end, shoulders & neck 489 RPM — .0055 feed
Chamfer
F. Center drill
G. Cut off 82 RPM — .0035 feed H.S.S.



IN 1954 this same job takes...

5.40 min.

FLOOR TO FLOOR

A. Turn 694 RPM — .022 feed
B. Turn 694 RPM — .022 feed
C. Turn 694 RPM — .022 feed
D. Turn 694 RPM — .022 feed
E. Face end, shoulders and neck — 694 RPM — .055 feed
Chamfer
F. Center drill
G. Cut off 489 RPM — .0025 feed

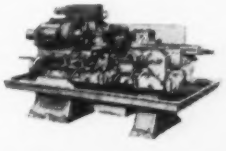
J & L TURRET LATHES GIVE...

MORE Ease of Operation
MORE Power Transmission
MORE Rigidity
MORE Accurate Stops
MORE Efficient Lubrication
MORE Coolant on Cutting Tools
MORE Accurate Results

Visitors who attend J&L's periodic "Production Studies" Seminars see this job turned out in just 5.40 min. on a Jones & Lamson #7A Universal Turret Lathe.

Only with lathes like this, built with plenty of power and the beef to back it up, can your shop take full advantage of the quality, productivity and lower costs offered by High Velocity Turning.

This job is one of the many turned at high speeds on our production line. Come to Springfield and see for yourself. At any rate, send for catalogs #101-A and #102.



JONES & LAMSON

Machine Tool Craftsmen Since 1835

JONES & LAMSON MACHINE CO., 512 Clinton St., Dept. 710, Springfield, Vt., U.S.A.

J&L MACHINE TOOL DIV.

For more information on products advertised, use Inquiry Card, page 265

EATON-RELIANCE

Industrial fasteners help produce these products (and many more) BETTER, FASTER and for less!

Reliance Spring Lock Washers, available in all types, sizes and analyses, keep bolted assemblies *tighter longer*. For complete lock washer information, write for Engineering Bulletin W-50.

Eaton Standard Springtites and Sems speed production by combining spring washer and bolt or screw into one easily handled part. Engineering Bulletin S-49 has all the details.

Reliance Cold Finished Steel is available in rounds, squares, flats or special shape sections in wire sizes 020 x 020 x ½ to ⅝ in coils or cut to length. Write direct for information on sizes, shapes and analyses.

Reliance Hoz-Fas-Ners save time and money wherever rubber, plastic or fabric hoses are used. Rust resistant, re-usable, one piece design . . . maintain uniform automatic tension. Write for Engineering Bulletin No. 1.

Reliance Snap Rings save man hours and material on shaft assemblies, bearing applications and in counterbore assemblies. Shoulders quickly formed by machining a groove and snapping in a Reliance ring. Send for Bulletin 4K/3.

Eaton Thread-Cutting Springtites and Sems eliminate tapping when fabricating products. They cut their own threads as they fasten assuring perfectly mated, tightly seated threads. Full information in Engineering Bulletin S-49A.

RELIANCE DIVISION EATON MANUFACTURING COMPANY

Springtites & Sems · Snap & Retaining Rings · Special Steels · Spring Lock Washers · Hoz-Fas-Ner

OFFICE and PLANTS: 507 Charles Ave. MASSILLON, OHIO

SALES OFFICES: New York • Cleveland • Detroit • Chicago • St. Louis • San Francisco • Montreal

For more information on products advertised, use Inquiry Card, page 265

HEAVY LOAD/LIGHT WORK

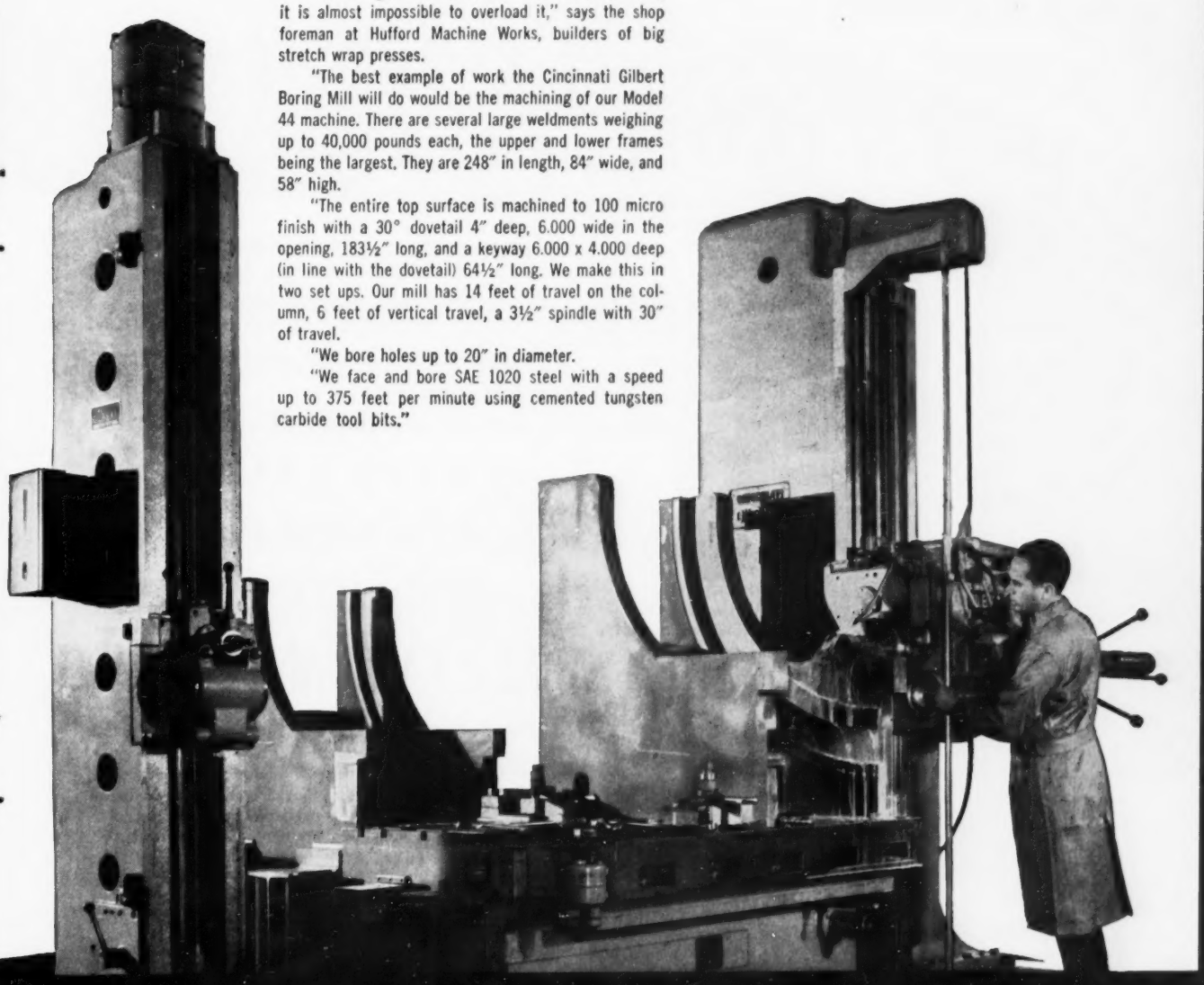
"The thing I like about the Cincinnati Gilbert is that it is almost impossible to overload it," says the shop foreman at Hufford Machine Works, builders of big stretch wrap presses.

"The best example of work the Cincinnati Gilbert Boring Mill will do would be the machining of our Model 44 machine. There are several large weldments weighing up to 40,000 pounds each, the upper and lower frames being the largest. They are 248" in length, 84" wide, and 58" high.

"The entire top surface is machined to 100 micro finish with a 30° dovetail 4" deep, 6.000 wide in the opening, 183½" long, and a keyway 6.000 x 4.000 deep (in line with the dovetail) 64½" long. We make this in two set ups. Our mill has 14 feet of travel on the column, 6 feet of vertical travel, a 3½" spindle with 30" of travel.

"We bore holes up to 20" in diameter.

"We face and bore SAE 1020 steel with a speed up to 375 feet per minute using cemented tungsten carbide tool bits."

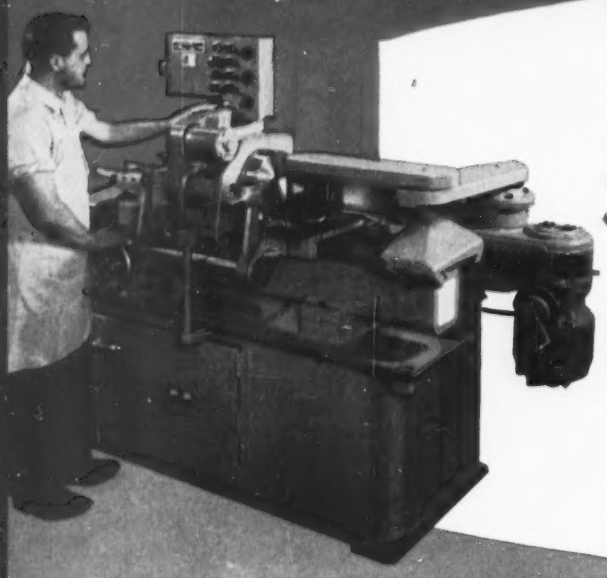


Centralized controls, frictionless response, maximum flow of power from motor to tool make light work of heavy loads on a Gilbert. Hufford uses a floor type machine with sliding table. Many other arrangements are available. Write for literature on these versatile machines.

GILBERT

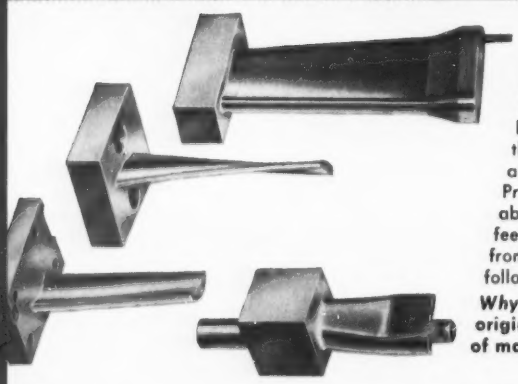
THE CINCINNATI GILBERT MACHINE TOOL COMPANY • 3366 BEEKMAN STREET, CINCINNATI 23, OHIO

NOW FIRST TO PRODUCE ORIGINAL 3-DIMENSIONAL AIRFOIL SHAPES



- WORKING DIRECTLY FROM SIMPLE CROSS-SECTIONAL TEMPLATES AND DATA ON AIRFOIL DRAWING
- WITH AUTOMATIC INTERPOLATION—TRUE FAIRING BETWEEN AND BEYOND THE CROSS-SECTIONAL STATIONS
- WITH NON-CONTACTING TRACER CONTROL
- PRECISION MACHINED
- IN HOURS INSTEAD OF WEEKS

NEW MODEL 102 electronic AIRFOIL MILLING MACHINE



Heretofore original masters were made by hand — no generating method being available. Now, in a matter of hours rather than weeks, the first master can be produced — hours in a single machine rather than weeks of skilled bench work. Simple templates, made to represent designer's airfoil cross-sections, together with data on drawing, are the only "special tools" needed by the machine. True fairing between and beyond the designated cross-sections is automatically produced by the machine interpolation systems. *True* fairing of shape and of twist-of-shape is accomplished automatically.

Principal motions of workpiece during generation of master airfoil are: (1) rotation about axis, (2) high-speed motion of milling head to and from axis, and (3) slow feed of milling head parallel to axis. Signals to produce motion (2) are obtained from the completely new NON-CONTACTING tracer control, which always exactly follows, *but never contacts* the constantly changing interpolation "flexure".

***Why not use this method* to generate the whole airfoil surface on your original airfoil masters — and, in addition, to provide a convenient means of machining pilot production runs?**

USE THIS COUPON TO SEND FOR COMPLETE INFORMATION

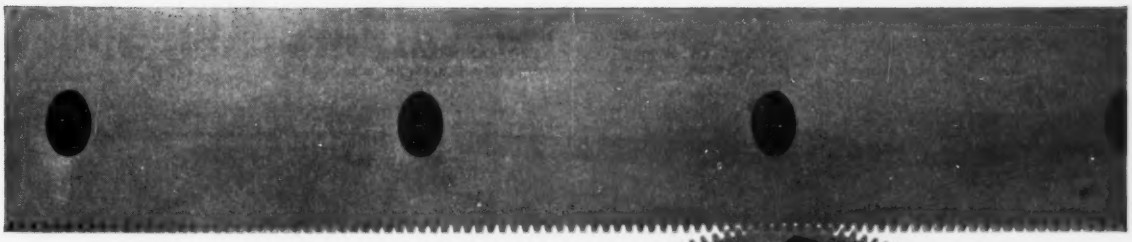
MANUFACTURED BY THE NEW ENGLAND MACHINE & TOOL COMPANY
Sales ... and Complete Sales Engineering and Maintenance Service ... Exclusively Through

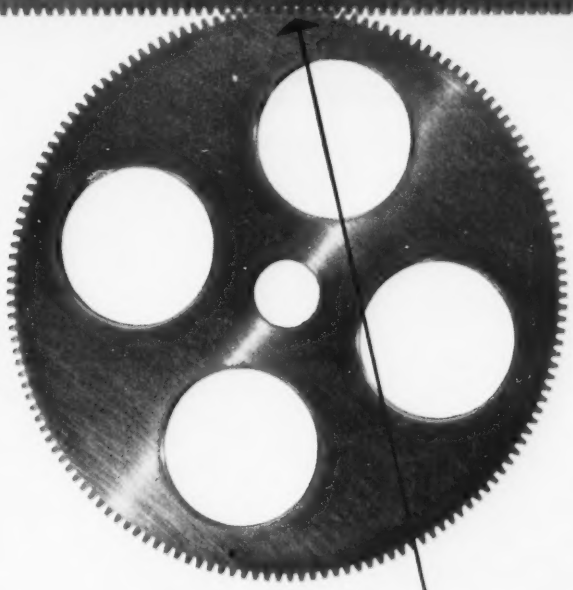
PRATT & WHITNEY
DIVISION NILES-BEMENT-POND COMPANY
WEST HARTFORD 1, CONNECTICUT, U.S.A.
SINCE 1860
First Choice for Accuracy
BRANCH OFFICES IN PRINCIPAL CITIES
MACHINE TOOLS • CUTTING TOOLS • GAGES

PRATT & WHITNEY — DIV. NILES-BEMENT-POND CO.
12 Charter Oak Blvd., West Hartford 1, Conn.

Please send my free copy of Circular No. 575 fully describing the new Model 102 Airfoil Milling Machine.

NAME _____
POSITION _____
COMPANY _____
CO. ADDRESS _____
CITY _____ ZONE _____ STATE _____





Why you can *reduce rejection losses* with a Kodak Conju-Gage Gear Checker

Why the composite check

In practice, the final test of gear quality is how the gear works in use. The composite check recommended in American Standard B6.11-1951 shows this conclusively by measuring displacement of the gear when run against a master of known accuracy. And it does it in one quick operation that checks combinations of as many as six types of errors.

Why the Conju-Gage Gear Checker

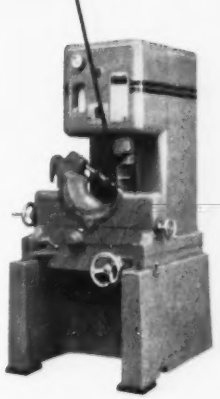
Since displacement represents the sum of both gear error and error in the master, the accuracy of the master used determines the precision of the composite check. The Kodak Conju-Gage Gear Checker uses a master of exceptional accuracy, the Conju-Gage Worm Section. Produced by thread grinding, its accuracy is not limited by the same manufacturing processes which limit accuracy in the gear itself.

To settle for masters of lesser accuracy is to rob yourself of "tenths"—to chance that tolerable error in a gear may coincide with error in the master to cause a needless rejection. Or that intolerable error in a gear may be cancelled by error in the master to pass a gear that will fail in use.

To reject every wrong gear is to guard the quality of your product. To pass every right gear is to reduce such rejection losses to a minimum.

To find out more about how a Kodak Conju-Gage Gear Checker can lower costs while maintaining required precision, send for your copy of the booklet, "Kodak Conju-Gage Gear Testing Principle." Write to

Special Products Sales Division
EASTMAN KODAK COMPANY, Rochester 4, N.Y.



The Kodak Conju-Gage Gear Checker automatically records the composite effects of runout, base pitch error, tooth thickness variations, profile error, lead error, and lateral runout. Illustrated is the Kodak Conju-Gage Gear Checker, Model 8U, for gears up to 8¼" pitch diameter. Smaller models are also available.

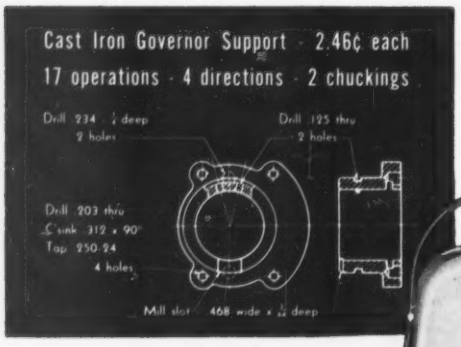
CONJU-GAGE **INSTRUMENTATION**

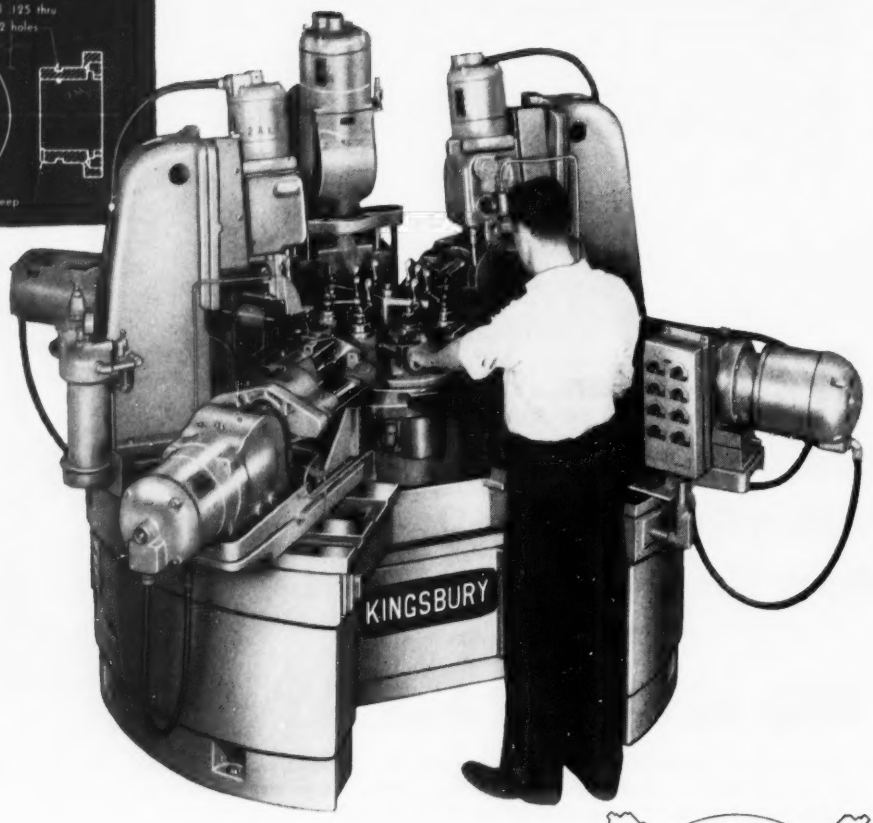
. . . a new way to check gear precision in action

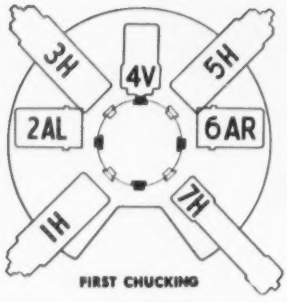
To inspect all kinds of complex parts on a bright screen, Kodak also makes two highly versatile contour projectors.

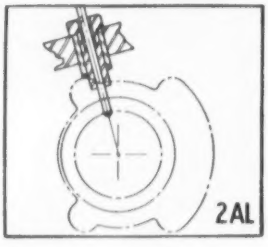
Kodak

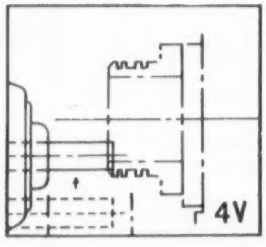
"Operations Kingsbury"

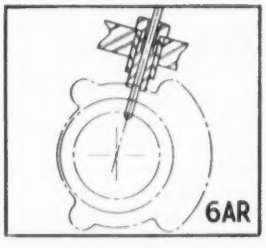

Cast Iron Governor Support - 2.46¢ each
17 operations - 4 directions - 2 chuckings
Drill .234 - ½ deep
2 holes
Drill .125 thru
2 holes
Drill .203 thru
C'sink .312 x 90°
Tap .250-24
4 holes
Mill slot - .468 wide x 5/64 deep

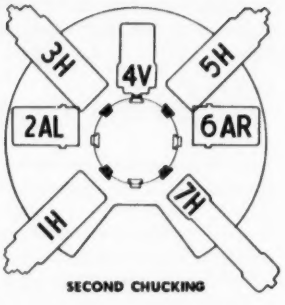












Follow this Kingsbury Automatic Machine as it performs

Actually better than that! It drills 8 holes, c'sinks and taps 4 of them, and mills a slot at the rate of 218 pieces per hour gross.

The part is a cast iron governor support small enough to palm in your hand. Print calls for 8 holes and a milled slot — 17 operations from 4 directions. Three operations are required at one end of the piece and 14 operations at the other. It was decided to accomplish these on one machine in two chuckings.

The machine has an 80-inch base with seven working units: four Horizontal Units (H), one Vertical Unit (V) and two units operating downward at an angle (AL left and AR right). The 30-inch Index Table has eight fixtures, four for each chucking. By means of selective tripping, the first chucking operations are performed at Stations 2, 4 and 6; the second chucking operations are performed at Stations, 1, 3, 5, and 7.

First Chucking

Station 2: Unit 2AL drills .125 hole through at angle 15° left.

Station 4: Unit 4V mills slot .468 wide x 5/64 inch deep through wall of part.

Station 6: Unit 6AR drills .125 hole through at angle 15° right.

produces interchangeable parts at low cost

"Operations Kingsbury" will provide you with parts of uniform accuracy . . . parts which will slip into your assemblies without reworking. Your part can be of any material that can be machined within the limits of 5 HP units and handled by one operator.

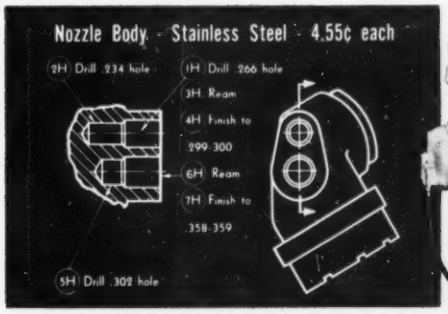
This broad claim is based upon field experience with more than 4,000 custom-built Kingsburys; a plant equipped with the most modern machine tools; a staff of experienced engineers and craftsmen specializing in this one line; and pride in doing it well.

Accuracy begins at home. Precision-built work-holding fixtures locate the part correctly for each tool. Precision ball bearings and bushing guides insure close tolerances. Predetermined feeds and speed are uniform and constant: multiple spindle heads are used only when it is safe to do so.

"Operations Kingsbury" offer additional money-wise advantages. Your scrap loss will be reduced to a minimum. You'll save floor space, set-up time and intra-machine rehandling.

Are you a good prospect? If so, we should like to see you.

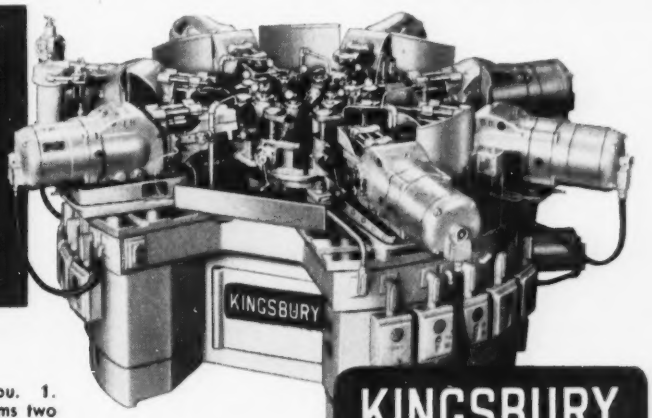
Kingsbury Machine Tool Corp.
106 Laurel Street, Keene, N. H.


Nozzle Body - Stainless Steel - 4.55¢ each
2H Drill .234 hole
1H Drill .266 hole
3H Ream
4H Finish to .299-.300
6H Ream
7H Finish to .358-.359
5H Drill .302 hole

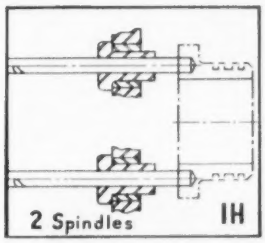
Stainless Steel Nozzle Body
21 operations per minute

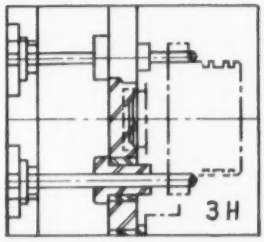
This Kingsbury holds three points of interest for you. 1. It drills stainless steel at 66 FPM. 2. It finish-reams two holes to ±.0005 on diameters. 3. It averages 1,274 operations per hour, producing 182 pieces gross.

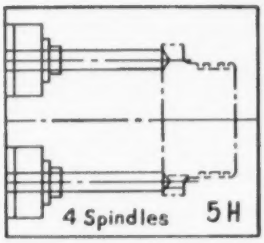
The machine has an 80-inch base with seven horizontal work units, all radial. The 24-inch index table has eight work fixtures, one for loading and unloading; and indexes clock-wise through 8 stations. Bushings guide all drills and reamers.

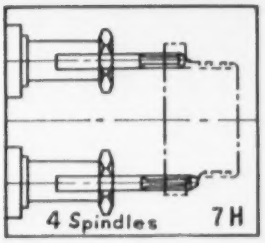


KINGSBURY
AUTOMATIC DRILLING AND TAPPING MACHINES
for Low-Cost High Production









17 operations at an average of one every second!

Second Chucking

Operator removes part and reloads with a new part placed end for end in work fixture as shown in the plan view.

Station 1: Unit 1H with two-spindle head drills two .234 holes ¼ inch deep.

Station 3: Unit 3H with four-spindle head drills four .203 holes through.

Station 5: Unit 5H with four-spindle head c'sinks .312 x 90° the four holes drilled at Unit 3H.

Station 7: Unit 7H with four-spindle head taps the four holes with .250 — 24 Taps.

Parts for both chuckings are loaded and unloaded at eighth position during machining cycle. Bushings guide all drills.

Each Unit Cost on the drawings
includes the cost of the man and of the machine — no power or overhead. We assumed:
Unit cost of man equal to:

$$\frac{\text{average U. S. hourly wage}}{\text{hourly gross} \times 80\% \text{ efficiency}}$$

Unit cost of machine to be:

$$\frac{\text{price of tooled machine}}{\text{output in 6000 hrs. @ 80\% efficiency}}$$

* Engine
* Removable block gap
* Extension bed gap

Nebel LATHES CINCINNATI

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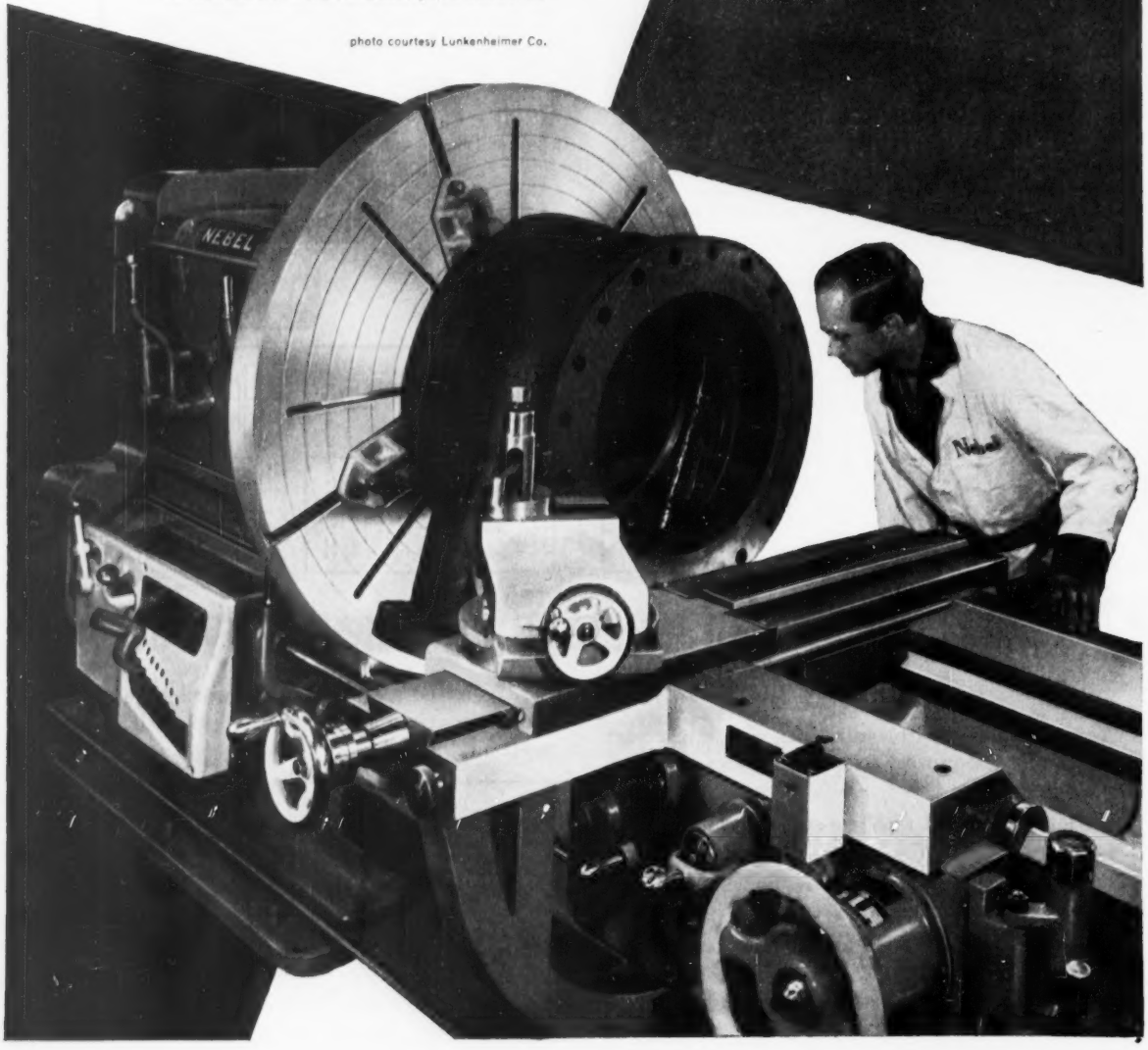
economical
big
fast
powerful
productive
versatile
big capacity
accurate

First, last and always Nebel lathes are accurate. They're Nebel designed, engineered, built and thoroughly tested to meet tomorrow's standards of accuracy today! We will proudly send you on request test sheets on current models to back up this statement. Nebel line includes engine, removable block gap and extension bed gap lathes, swing sizes 16" to 50". Write The Nebel Machine Tool Co., 3410 Central Parkway, Cincinnati 25, Ohio for descriptive bulletins.

photo courtesy Lunkenheimer Co.



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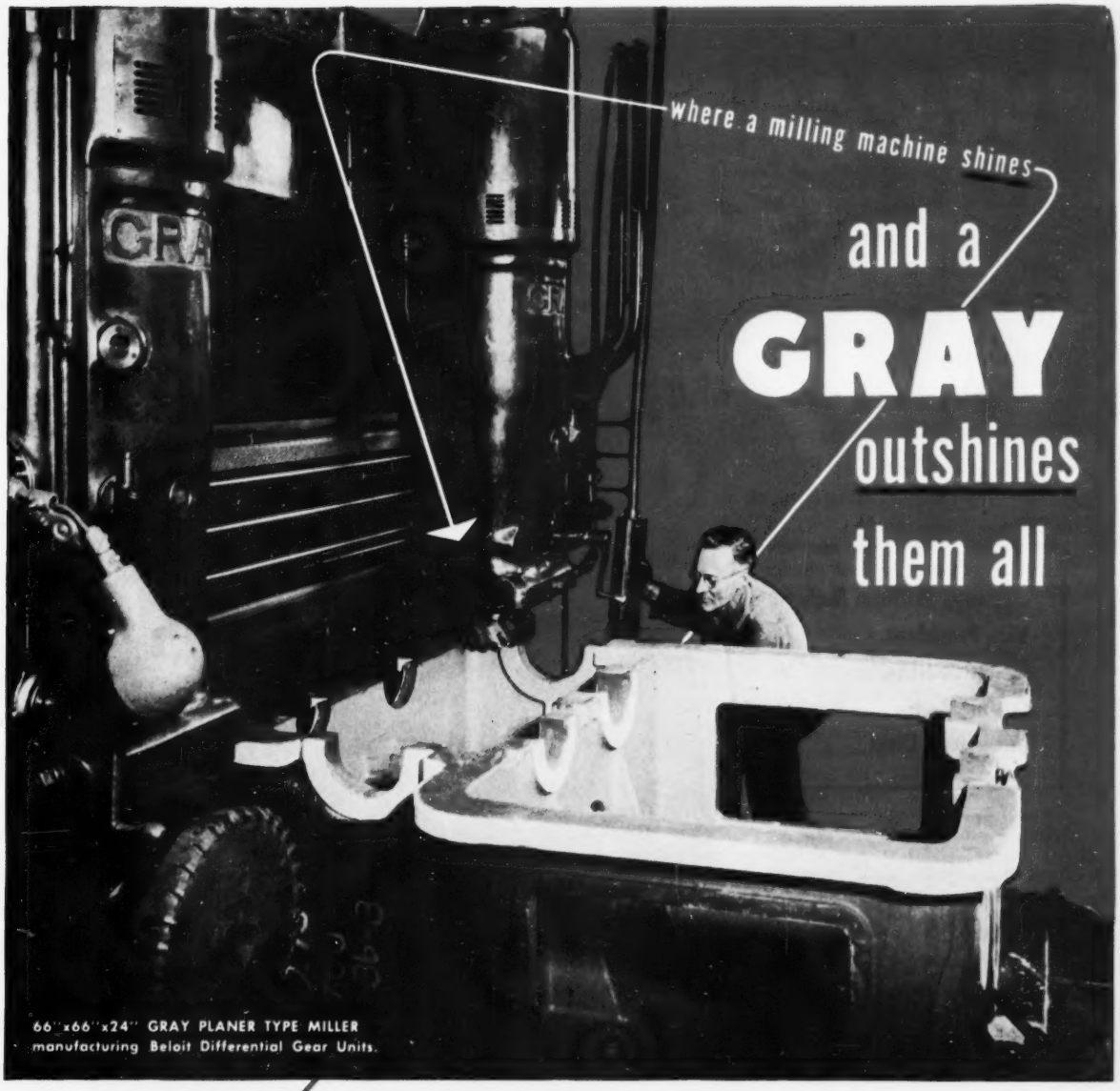

66" x 66" x 24" GRAY PLANER TYPE MILLER manufacturing Beloit Differential Gear Units.

When it comes to delivering HIGH LOW COST PRODUCTION... GRAY PLANER TYPE MILLERS really shine in up-to-the-minute plants where only the finest precision work is acceptable.

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- Compact GRAY Unit Heads make possible a wide variety of simultaneous high horsepower cuts. Each head has individual spindle motor.
- Speeds up to 1000 RPM are instantly obtained by the flick of a lever.
- Low Hung Drive to the spindle through a balanced planetary gear train with fly wheel inertia provides the ideal high horsepower carbide cutter drive.
- Efficient swivel or non-swivel design heads as desired.

a GRAY will shine in your plant when you see how it increases production — reduces time and costs.

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planers • milling planers
planer type milling machines
horizontal boring machines

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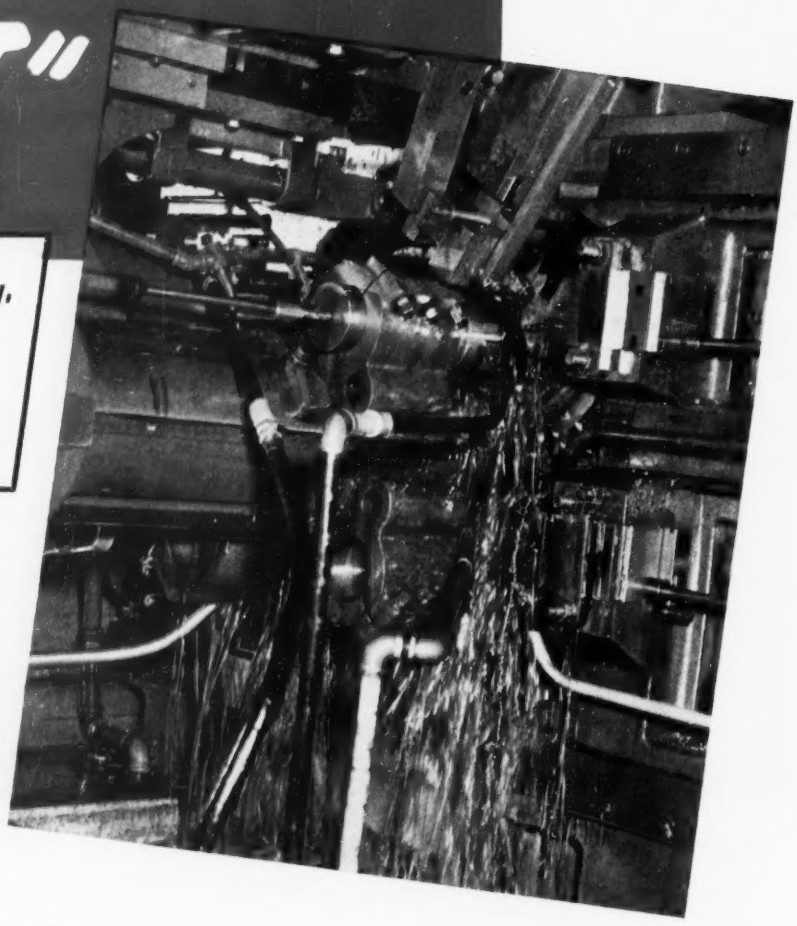
"WE CAME BACK TO TEXACO FAST"

. . . says William Mahoney, Vice President, Tyson Bearing Corporation, Massillon, Ohio



"About three years ago," reports Mr. Mahoney, "we had a chance to make a direct comparison between *Texaco Cleartex Oil* and another brand of dual-purpose oil in our National Acme automatics. This other oil not only discolored and oxidized copper but quickly created a very dirty condition on the lubricating sides of the machines. We came back to Texaco — *fast !*

"Within a matter of days after the *Texaco Cleartex Oil* went back, the lube sides of the automatics were clean as a whistle again, and we have had no more trouble since that time."

Texaco Cleartex Oil is an exceptionally fine dual-purpose oil for use in automatic screw machines as cutting coolant and machine lubricant. It is just one of the complete line of *Texaco Cutting, Grinding and Soluble Oils* designed to help you do *all* your machining better, faster and at lower cost.

Let a Texaco Lubrication Engineer specializing in cutting oils help you select the right ones for your jobs. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

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TEXACO

TEXACO CUTTING, GRINDING, SOLUBLE AND HYDRAULIC OILS

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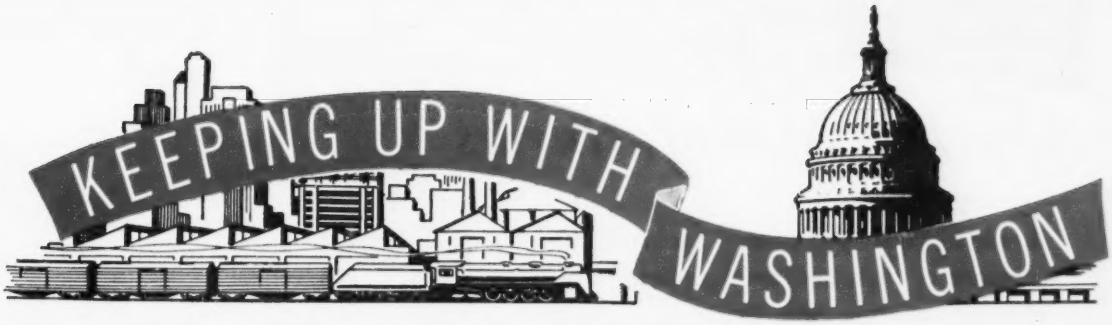


By LORING F. OVERMAN

Would Involvement in Indo-China Bring Back Controls?

THE possibility of the cold war turning hot in Southeast Asia is getting much attention in Washington these days. People are wondering (1) Would there be controls, and if so what kind? (2) Would participation in the conflict be a money and arms affair? (3) Would the Navy and Air Force be employed? (4) Could participation in Indo-China lead to all-out war?

Straws in the Wind

The average citizen finds it unthinkable that we may again be involved in jungle fighting in some far-off corner of the world. But within the Government, it has become quite apparent that participation in Southeast Asia is being viewed as a distinct possibility. One possible weather vane is the fact that the Office of Defense Mobilization is planning to start meeting soon with businessmen and former government officials for the purpose of compiling an inventory of personnel who could be tapped to serve in control agencies—if, when, and as. The inventory is to include a roster of positions which would have to be filled if a mobilization program were put into effect. The group of management experts and government people compiling the roster would then list the men it feels best-suited to fill the middle positions, the working level.

By midsummer, it is indicated, the inventory schedule calls for interviews with candidates, to determine whether they would serve in an emergency. The roster will provide for an orderly enrollment of personnel in the event that quick formation of control agencies becomes necessary.

ANOTHER project, which may be viewed either with alarm or with calmness depending upon one's point of view, involves certificates of necessity for accelerated amortization of expanded defense facilities. Recent announcement of the issuance of certificates for 69 new projects valued at more than $53,000,000 brings to nearly $30,000,000,000 the sum total of amortization certificates granted for 19,170 new or expanded facilities. The step-up in issuance of certificates, ODM officials say, is to expand industry's capacity to meet possible mobilization goals with a minimum of government plant ownership.

Perhaps with the idea of developing further capacity without too much official notice of possible defense purposes, a change in the five-year amortization plan is under consideration. In the past, a company could qualify for certificates of necessity only if a contribution to the defense mobilization base could be shown. New rules may permit amortization of modernization programs, the thought being that keeping the machinery up-to-date would, in itself, contribute to the defense effort in an important manner.

On the Other Hand

While perfectly willing to let it be known that all is not quiet on the Southeastern front, Washington spokesmen hasten to reassure inquiries that current preparations are nothing out of the ordinary. The ODM has been in operation continuously since Korea, they point out, and the stockpiling program and other defense efforts have continued with little let-up.

Probably because of the attention that has been paid to keeping the mobilization base adequate, a moderate return to arms would not place a great strain on the economy. Weapons and scarce materials have been stockpiled in generous quantities, and several important arms programs are either nearing completion, or well under way. As a result, it is not thought that serious controls of raw materials or consumer goods would be an early result of Asiatic involvement. The Government now has the power to control raw materials, and it may be expected that the stockpiling program will be stepped up, just in case. But if things continue in their present course, it is expected that the President will ask Congress for power to freeze prices, wages, rents, credit, and inventory for a ninety-day period while Congress looks the situation over.

Meanwhile, More Money

As a result of the tenseness in world affairs, some members of Congress are wondering whether recent cuts in the defense budget have been too drastic. Senator Maybank, for example, a member of the Appropriations Committee, has proposed a 10 per cent increase in the military budget for 1955 planned by the Administration, which amounts to $37,500,000,000. The House-approved defense appropriation bill authorizes only $28,600,000,000. The difference would be made up from unspent carry-over funds. Reconsideration of the defense budget smoothed the way to restore the $250,000,000 fund which had originally been earmarked by the Department of Defense for use in buying machine tools for the mobilization base.

Washington Briefs

THE Senate Judiciary Sub-committee has approved a resolution calling for a Constitutional amendment that would permit the President to reject certain items in money bills, while approving the remainder. Such a provision would put a stop to the practice of attaching objectional riders to appropriation bills.

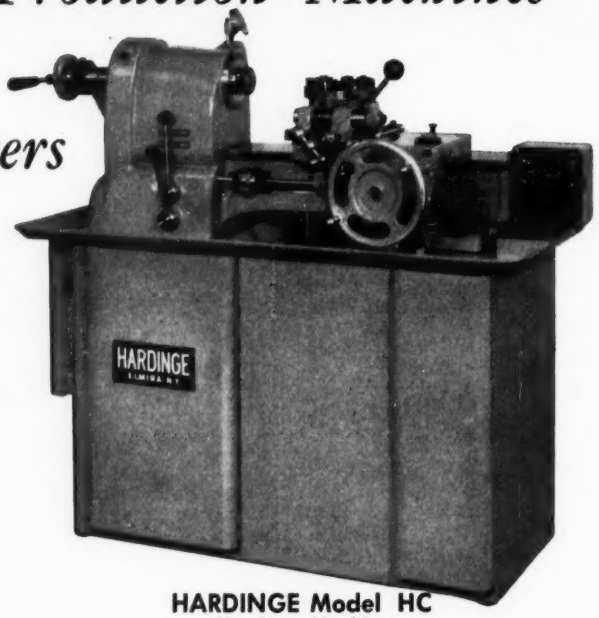
TO assist the titanium industry in developing a civilian market for titanium mill products, the Business and Defense Services Administration, United States Department of Commerce, has issued BDSA Order M-107 freeing 10 per cent of each month's output for non-military uses. Prospective markets include such fields as chemical and food-processing equipment, aircraft, automobiles, and electronics.

AMENDMENT 4 to BDSA Order M-11A reduces the percentages of mill space required to be reserved for production of copper and copper-base alloy products for military and Atomic Energy Commission needs.

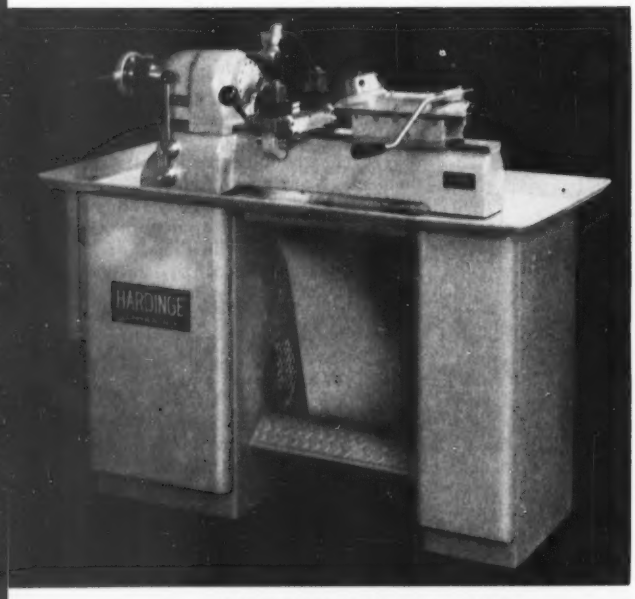
HARDINGE
ELMIRA, N.Y.

Precision Production Machines for Aircraft Manufacturers

THERE is a widespread general acceptance of these machines as being capable of meeting the extreme accuracy requirements of the aircraft industry. They combine high speed, accuracy, ease of operation, and low initial cost. This means tool room accuracy, better part finish and low cost production. These fast-action machines are cutting costs on jobs which were usually allotted to large, slow and expensive machines.



HARDINGE Model HC
Chucking Machine
Collet capacity 1", Chucking capacity 6", Swing 13"

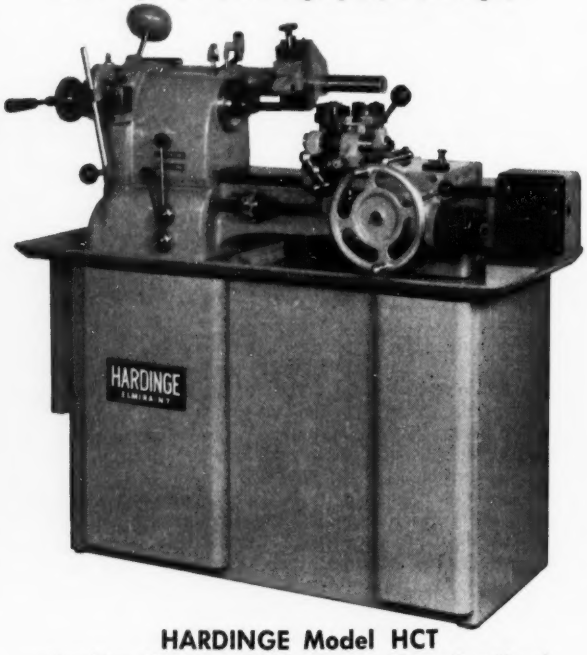


HARDINGE Model DSM 59
Second Operation Machine
Collet capacity 1", Chuck capacity 6"

The Hardinge Second Operation Machine is a time-tried production machine, easy to set up and relatively inexperienced operators can turn out parts rapidly to close tolerances and fine finish.

The extreme accuracy and high speed of this machine enable you to chuck partially finished parts and to rapidly do close tolerance turning, forming, boring, drilling,threading and facing.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"



HARDINGE Model HCT
Chucking Machine with Production Threading Head
Collet capacity 1", Chucking capacity 6", Swing 10", Internal and External Threading up to 6"

Hardinge Precision Chucking Machines can finish diameters, shoulders, end faces and cut precision threads in *one setting—all concentric* with each other.

Everyone responsible for the machining of precision parts appreciates the value of machines which can be quickly and inexpensively tooled. These Hardinge machines can be tooled with standard tool bits for fast production of precision parts.

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

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MACHINERY
JULY 1954

Air Leadership Could Depend on Depreciation Allowances

EVER-INCREASING reliance is being placed by the Military Services on the quality and performance of the Nation's fighting aircraft. This fact has multiplied the need for large investments in modern production machines and tools on the part of the aircraft industry. The extreme complexity of advanced military aircraft and constant changes in design demand the use of the most modern production and testing equipment, if this country is to maintain its leadership in the air.

It is unlikely that we shall ever again have time to prepare for war after war has been forced on us. The power of the fearsome atom and hydrogen bombs, and the range and speed of the aircraft with which they can be delivered, are such that a war today might be quickly decisive. There must be sufficient, up-to-date production facilities to meet any emergency ahead of time.

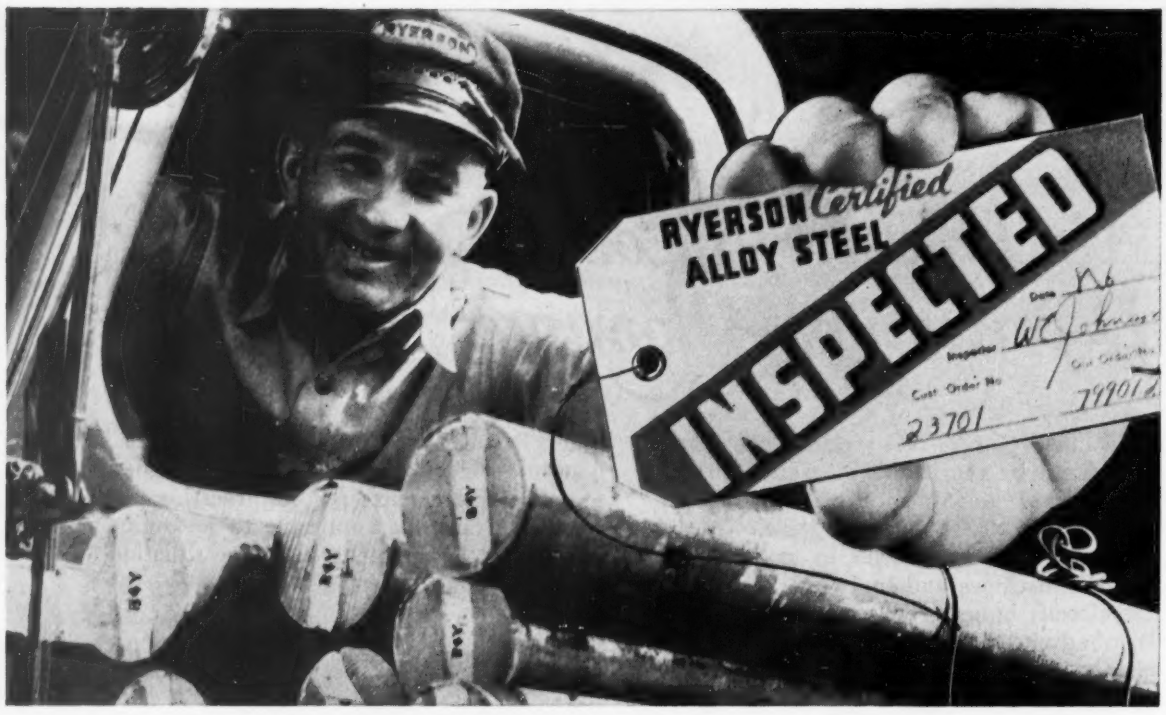
Great strides have been made by the aircraft industry in the development of unique methods which involve the use of new types of production equipment, as shown in this Fourteenth Aircraft Production Number. Nevertheless, a considerable proportion of the manufacturing equipment in aircraft factories is inadequate for possible future production requirements. Roy T. Hurley, president of the Curtiss-Wright Corporation, speaking before the recent S A E National Aeronautic Production Forum in New York City, stated that approximately 5300 of the 6800 machine tools in the Curtiss-Wright plants are over-age. Most of these machines, bought during World War II, were designed to manufacture parts for reciprocating engines, and are not applicable to jet-engine production. Undoubtedly the same situation exists in many other plants.

The present depreciation policy of the United States Treasury Department prevents the purchase of needed machinery. Curtiss-Wright should and would be spending about $10,000,000 annually for new equipment, according to Mr. Hurley, if the Government were to approve a liberal, accelerated depreciation policy. With the present policy, only a small portion of the cost of new equipment can be covered annually by depreciation allowances on the machines to be replaced. Consequently, a manufacturer cannot recover his investment within the useful life of the equipment. The major portion of the cost of modern machines and tools must be taken from earnings after taxes. New machine tools and increased application of automation principles would reduce the cost of aircraft engines, and so new equipment could pay for itself in short order.

A realistic depreciation policy that would permit the timely acquisition of new equipment and the replacement of obsolete machines is not only of prime importance to the leadership of the United States in the air but might well be the insurance of our survival. It is imperative that the Government act soon on this problem of vital importance to industry!

Charles O. Herb

EDITOR



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Under this unique Ryerson system of quality control, your protection begins with the careful selection of heats to be carried in stock. Next, we verify the analysis of each selected heat. Then, after spark testing to guard against mixed steels, we permanently identify each bar with a stamped heat symbol and color marking. Meanwhile, we test a sample of every heat for hardenability and interpret the test results for you.

Finally, before these selected steels are shipped, a thorough inspection is made to see that every step in the control plan is followed. Only then, after every detail has been double-checked, is your order of Ryerson alloys approved for delivery. And with your shipment you receive a certificate providing complete test data to prove quality and guide your heat treatment.

You pay no more for Ryerson Certified Alloys, but they will prove real money-savers for you. To get these controlled-quality steels promptly—just call your nearby Ryerson plant.

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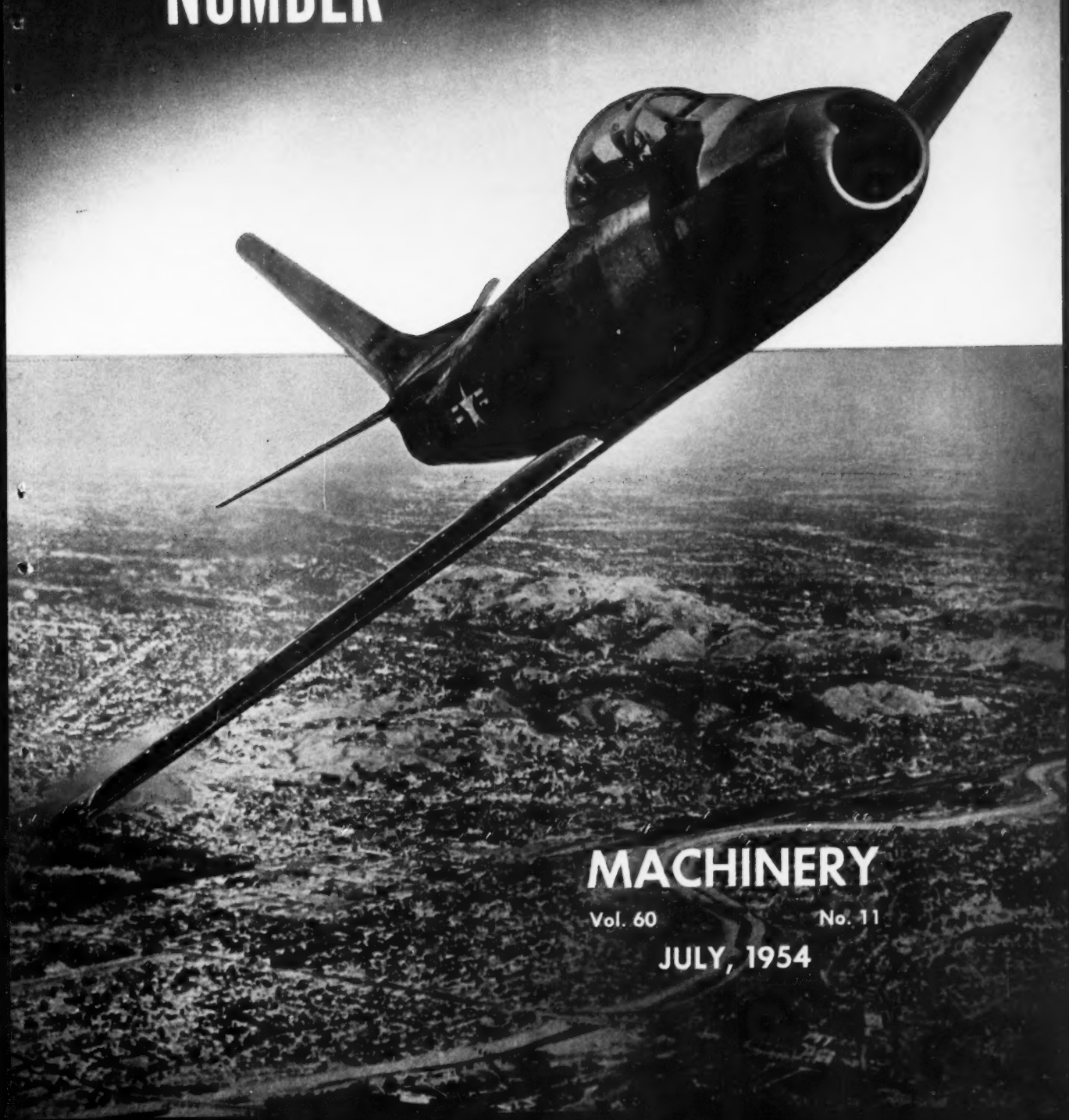
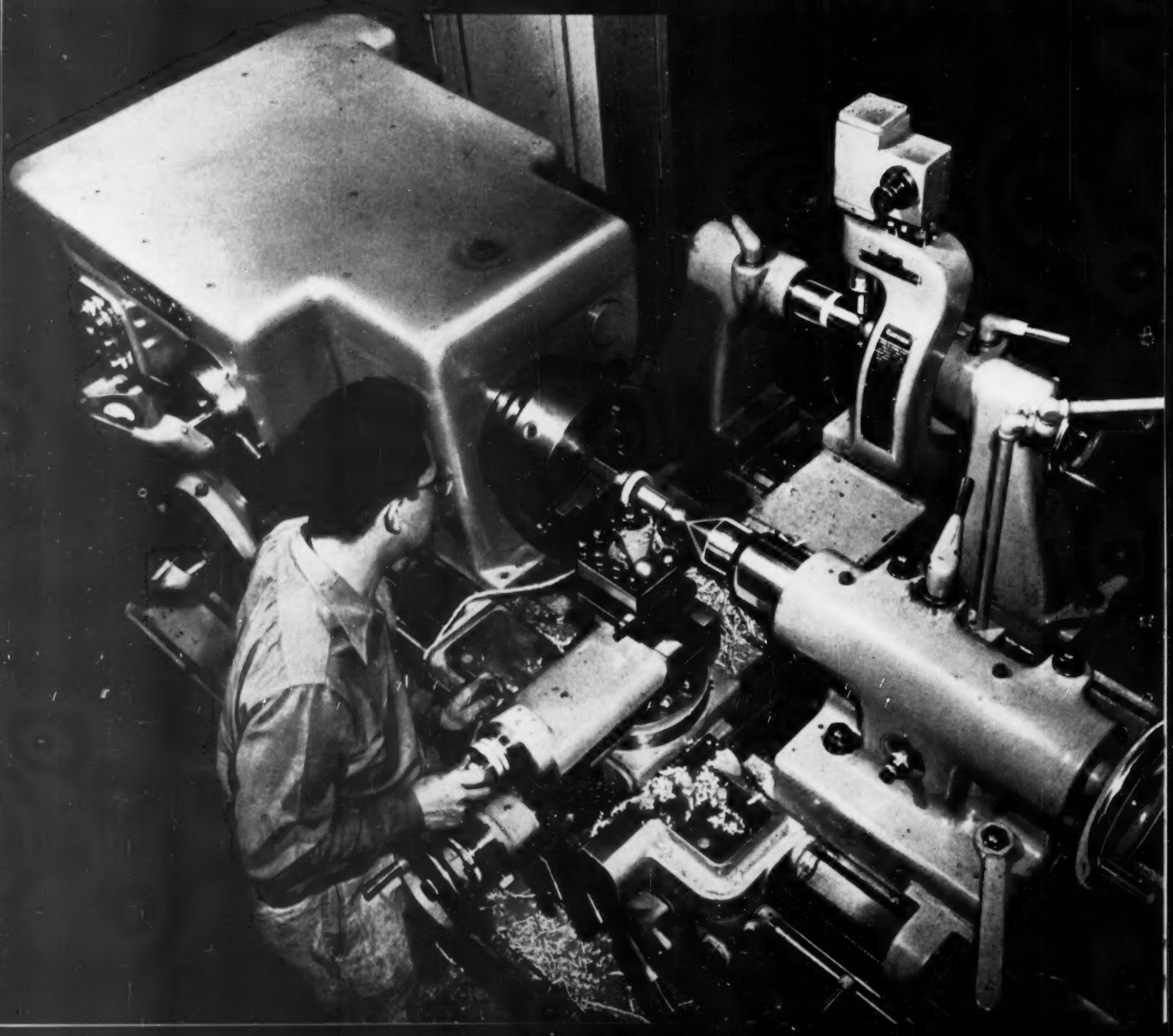
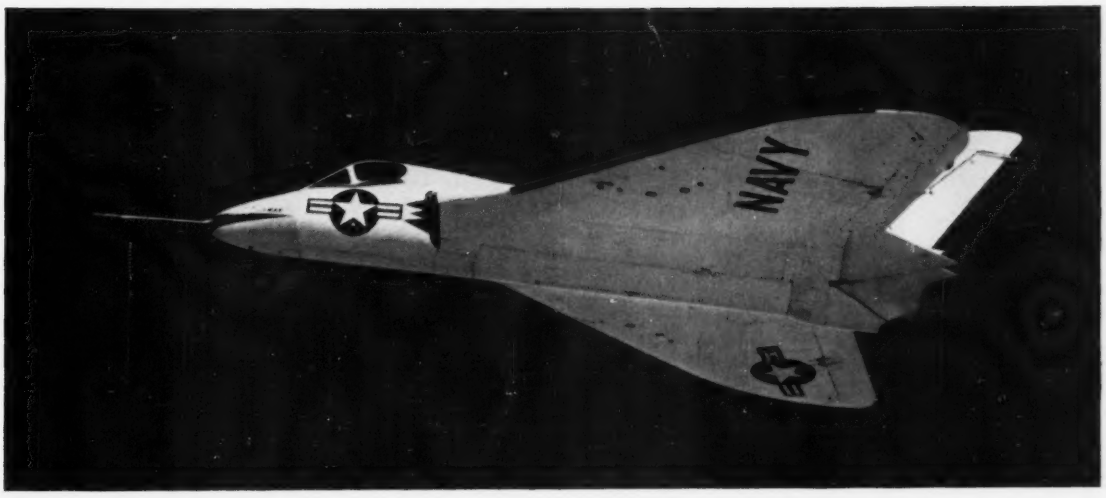
14TH AIRCRAFT PRODUCTION NUMBER



MACHINERY
Vol. 60 No. 11
JULY, 1954

The Newest Douglas Plant Model of Productive Efficiency





Douglas XF4D Skyray

THE phenomenal development of the aircraft industry with its mushrooming of manufacturing plants to meet the needs of national emergencies often did not permit time for the scientific planning of production facilities and procedure. This, however, is not true of the newest factory of the Douglas Aircraft Co., Inc. in Torrance, Calif., which is part of the El Segunda Division. This factory has been equipped to build planes for the United States Navy. Here advantage was taken of experience gained through years of aircraft production, and the plant is a model of efficiency.

Each department is a complete entity. Raw material arrives at one end of the department and when the work leaves the opposite end it has, for example, been completely machined, heat-treated, chromium- or cadmium-plated, and inspected. No work leaves any one department for an intermediary operation. In the machine shop, tools are ground adjacent to the machines on which they are actually used. No time is lost in tool delivery and there is no possibility of sending the wrong cutters to a machine.

Another feature of the plant is the wide divergence of equipment necessary to turn out the Navy's planes. The biggest machine is a Farnham spar-cap miller with a bed 308 feet long and equipped with eight gantries, each of which has two milling cutter heads. The total weight of this machine is estimated at approximately 372,270 pounds.

In contrast, there is a gear-cutting machine that hobs pinions as small as 1 4 inch in diameter and with teeth as fine as 120 diametral pitch. This article will deal with typical operations in the machine shop, where many parts must be produced within dimensional tolerances as close as plus 0.0005 inch, minus 0.0000 inch. The objective of the Douglas management is the mass production of high-precision parts.

Sidney lathes equipped with hydraulic tracer units are employed for a variety of operations. In the heading illustration is shown a 20-inch lathe tooled up for turning the cylinder head of a hydraulic unit, the part being produced from 75S-T aluminum alloy. An actual part mounted on the fluid tracer unit at the back of the bed controls the in-and-out movements of the cross-slide with its carbide cutters.

Other Sidney lathes similarly equipped with hydraulic tracing units are employed for such work as arresting-hook tubes and slide-valves. On the slide-valves, it is necessary to cut to reduced diameters between a series of integral collars that provide bearing surfaces. With the particular tracing unit provided on this machine, precise 90-degree movements of the tools can be made for accurately facing both the right- and left-hand ends of the collars. The cutters dwell momentarily when they reach the inner point of their cuts.

The Monarch engine lathe shown in Fig. 1 is employed in gun-drilling a hole through a solid aluminum forging 30 inches long. The operation is somewhat similar to trepanning, a rod 1 2 inch in diameter being produced by the inner edges of the cutters. Stock is removed at the rate of 1 cubic inch per horsepower per minute. The diameter of the finished hole is 3 inches, the carriage moves along the bed at a feed rate of 1 inch per minute, and the cutter-spindle revolves at 225 R.P.M. The completed bore must have a finish of 20 micro-inches r.m.s., and the error in straightness must not be more than 0.003 inch in the length of 30 inches. This is difficult to attain because of the heavy lug at one end of the forging. The tool, of course, supports itself in the

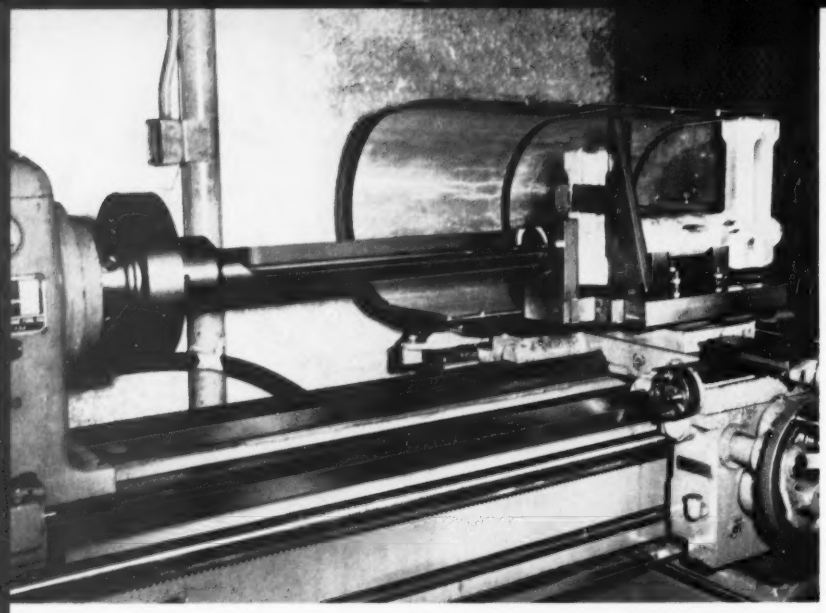


Fig. 1. Trepanning operation on a long aluminum forging, stock being removed at rate of 1 cubic inch per horsepower per minute

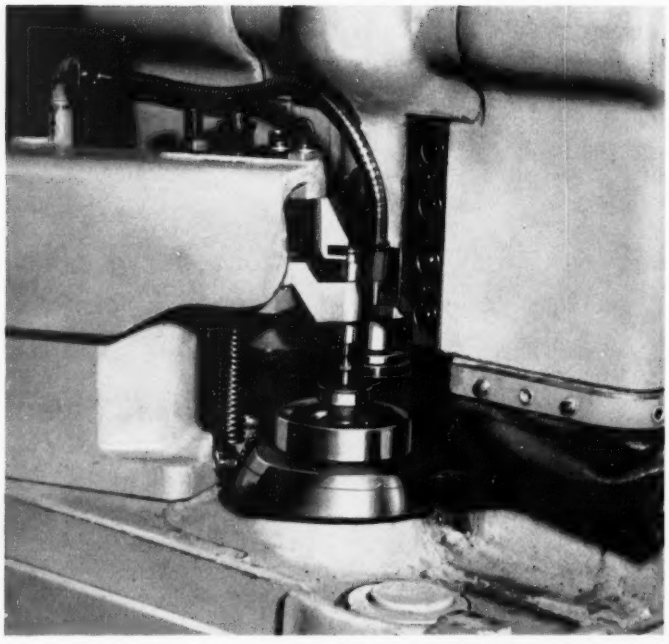


Fig. 2. Shaping the teeth on a small pinion of 120 diametral pitch, there being two integral gears on one shaft

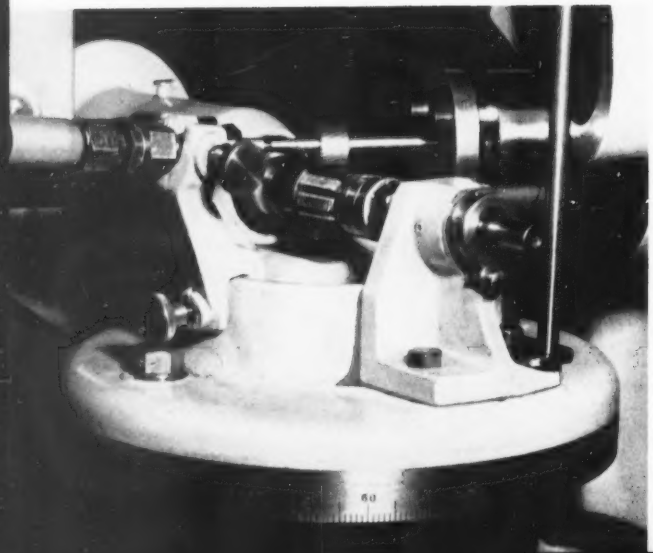


Fig. 3. Hobbing a helical gear only 0.645 inch in outside diameter, the teeth being of 48 normal pitch

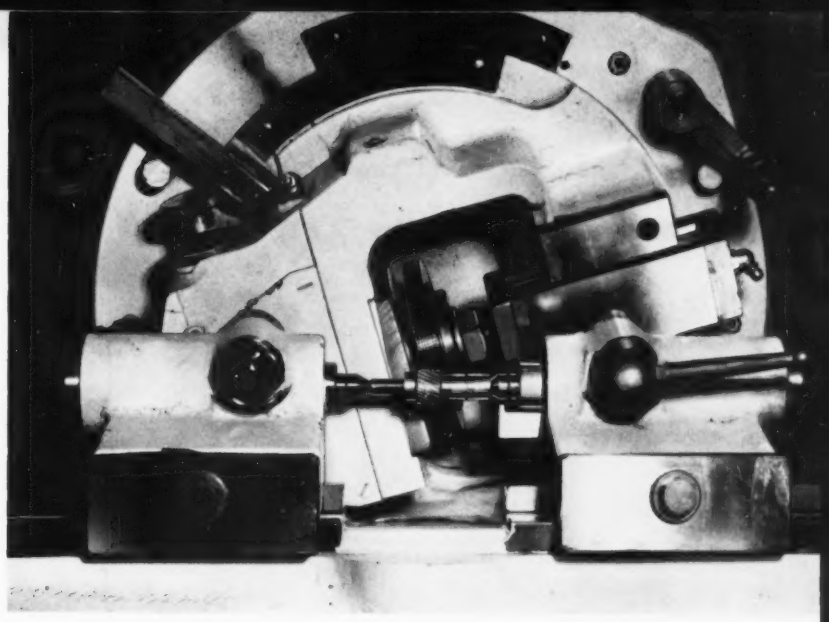


Fig. 4. Shaving the teeth of the small helical gear which was hobbed in the previous operation illustrated in Fig. 3.

bore that it cuts. The work is held in a fixture mounted on the cross-slide of the lathe. A plastic guard completely encloses the tool and work.

Gears of instrument classification are produced by several types of machines for service in flight control mechanisms. Illustrated in Fig. 2 is a Fellows gear shaper cutting the teeth of a pinion that is integral with a shaft on which a second pinion is also cut. The pinion being shaped has twenty-five teeth having a full depth of only 0.019 inch and a tooth thickness of 0.013 inch. The concentricity must be true within 0.0002 inch and the helical error must be held within the same tolerance. The permissible involute error is 0.0001 inch and the maximum backlash is 0.0005 inch.

Fine-pitch gears from 120 to 30 diametral pitch are produced on a Hamilton gear hobber, Fig. 3. The helical pinion seen on the machine has teeth of 48 normal pitch and is 0.645 inch in outside diameter. Gears up to 6 inches in diameter are cut with this equipment and splines up to 5 inches long. All gear blanks are ground prior to hobbing or shaping. The helical pinion being hobbed in Fig. 3 is subsequently shaved on the Fellows machine in Fig. 4. All gears are

Fig. 5. Reduced diameters between the bearing sections of slide-valves are ground from the solid in a plunge-cut operation.

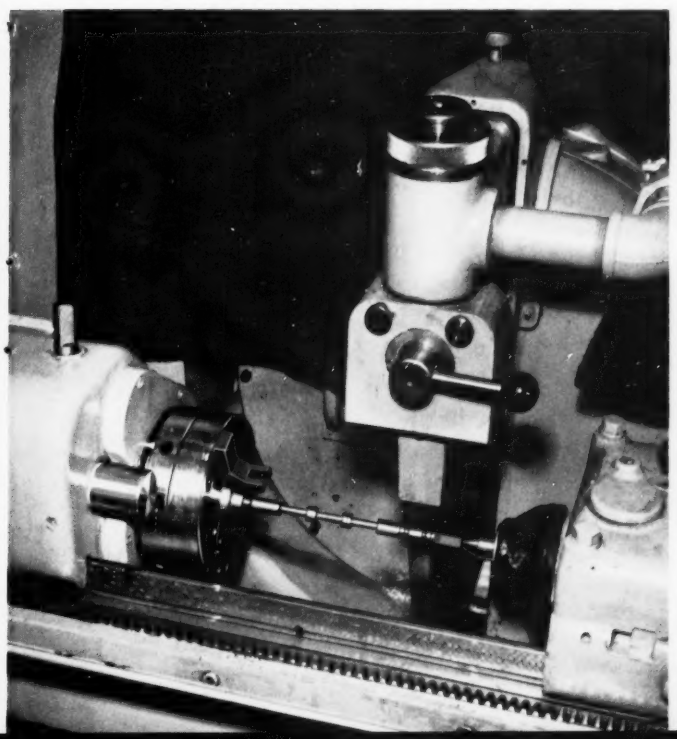
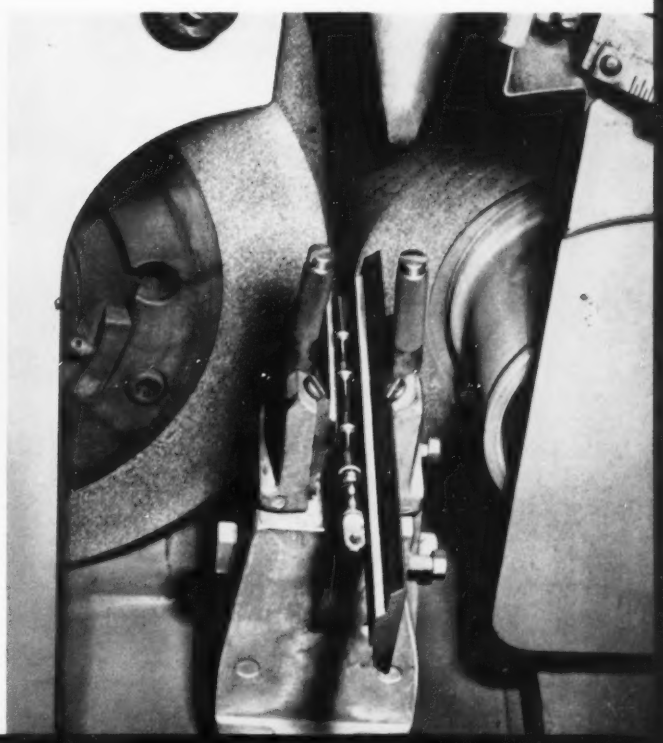


Fig. 6. Slide-valves are centerless ground on the bearing surfaces prior to transfer for a superfinishing operation.



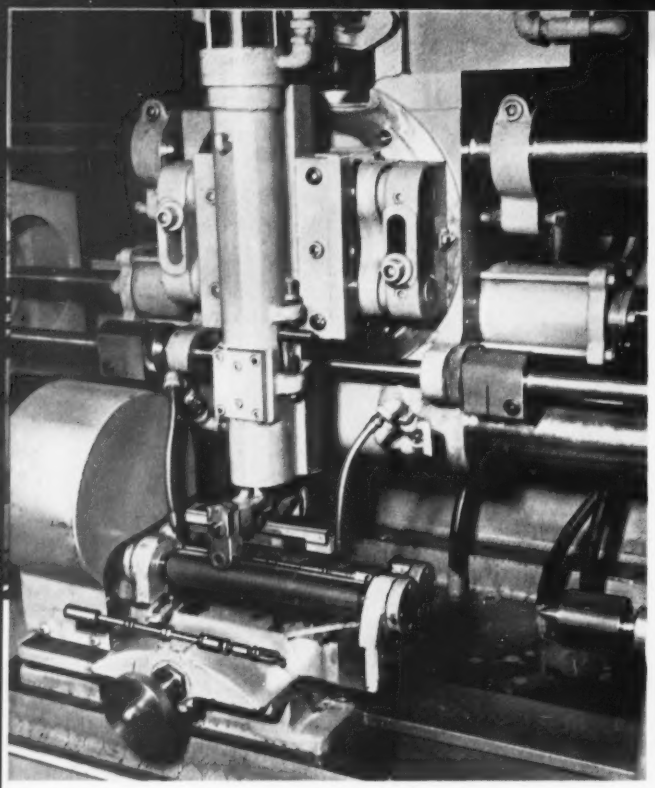


Fig. 7. Superfinishing operation in which the bearing surfaces of slide-valves receive a finish of 3 micro-inches r.m.s.

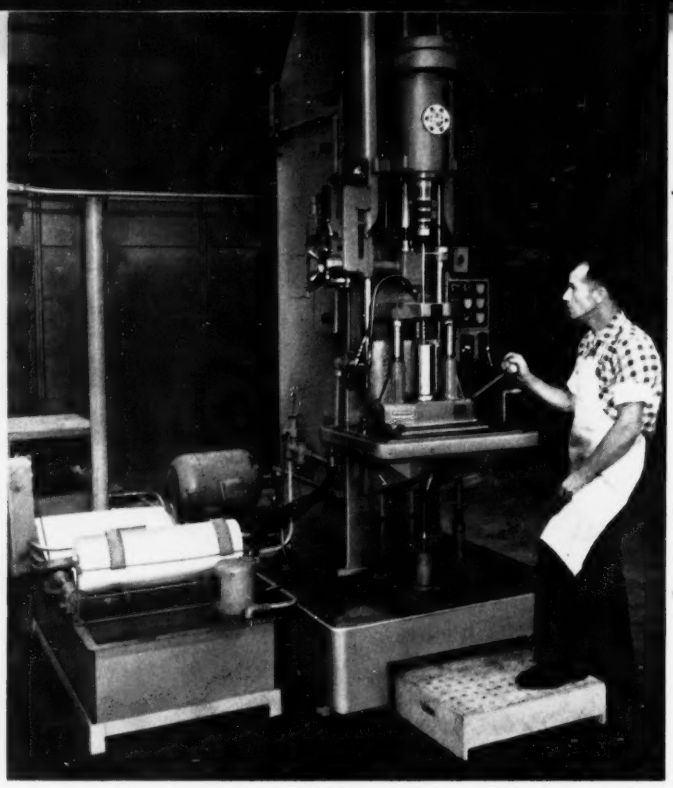


Fig. 8. Honing machine equipped with filtering unit for the honing fluid, used for a variety of precision parts.

checked with National Broach "Red Ring" inspection equipment.

Slide-valves of the type seen in the Jones & Lamson grinding machine, Fig. 5, are among the most precise parts produced in the machine shop since they must provide a close metal-to-metal fit in a sleeve. The final finish of the bearing surfaces must be as fine as 5 micro-inches r.m.s. These slide-valves are ground from the solid. The original diameter is 1/2 inch and the reduced diameter between the integral collars, or bearing surfaces, is 1/4 inch. The diameter tolerances are plus 0.0005 inch, minus 0.0000 inch, while linear dimensions are held to plus or minus 0.001 inch. The grinding wheel of this machine is trued with a cam-operated device, the cam being changed to suit each part.

After the slide-valves leave the cylindrical grinding machine, the outside diameters are finished in the Cincinnati centerless grinder illus-

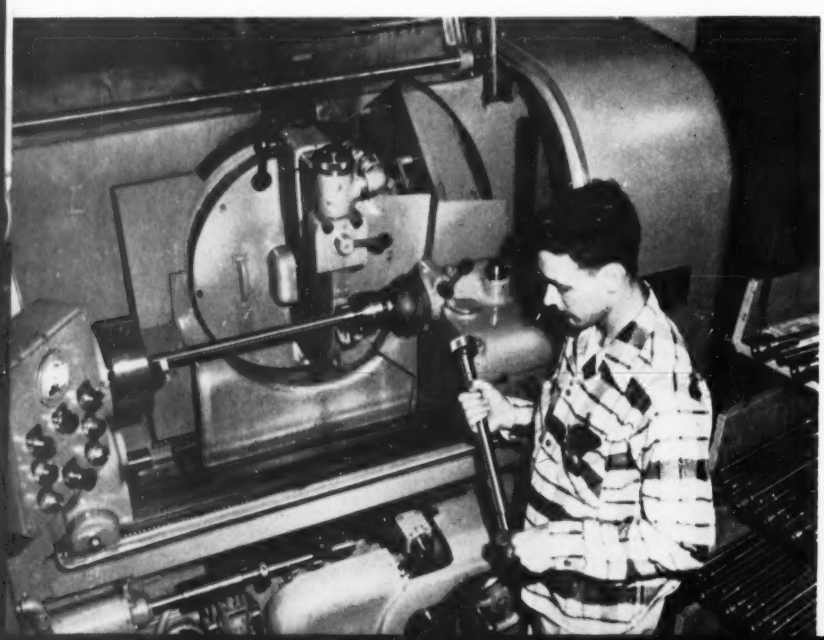


Fig. 9. Form-grinding the piston for a hydraulic unit which is integral with the piston-rod, the grinding wheel employed being crush-dressed

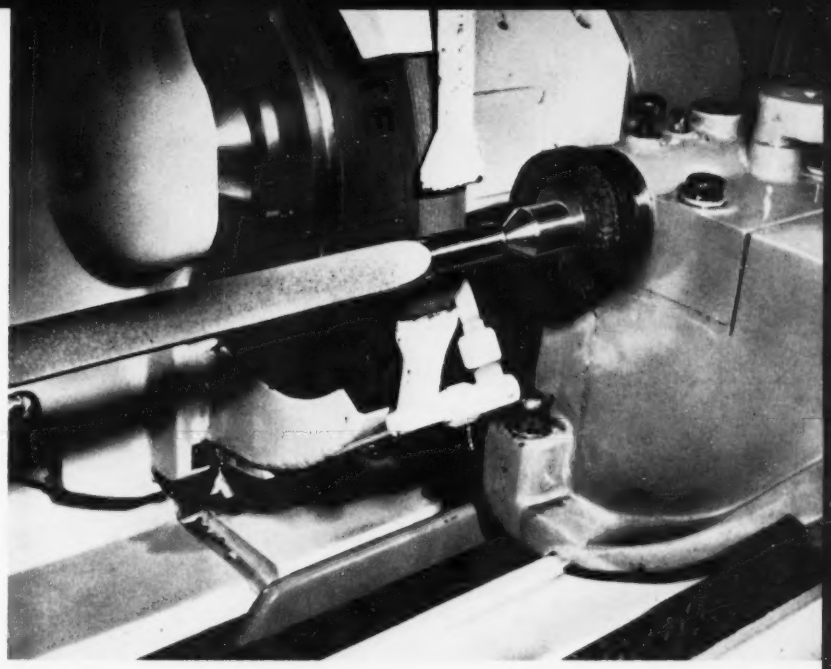


Fig. 10. Typical operation performed by multiple-thread grinding machine, this grinding wheel also being crush-dressed

Fig. 11. High-speed milling machines, provided with two fixtures to enable reloading while an operation is in progress, are used for a large variety of work.

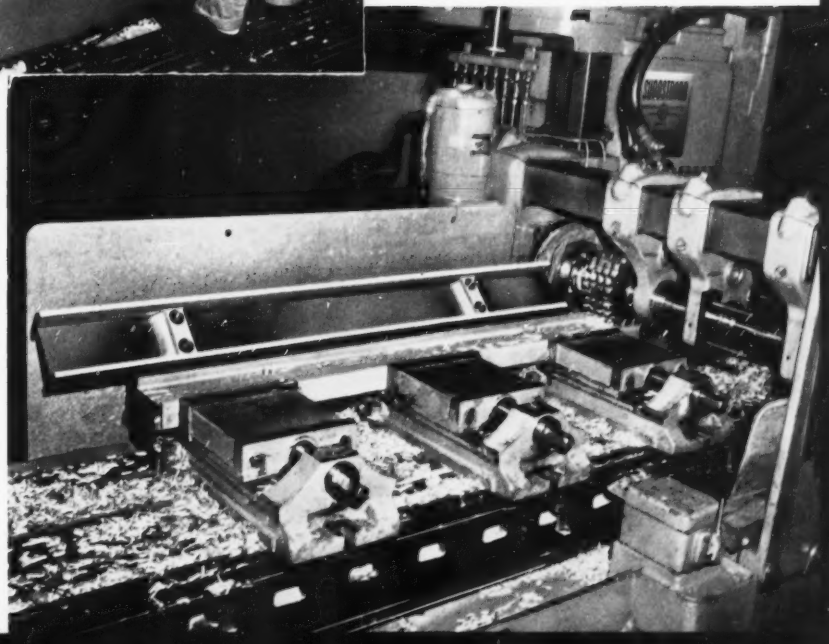


Fig. 12. (Right) Gang-cutter milling operation in which cutters rise and fall to obtain the desired contour on a comparatively wide surface

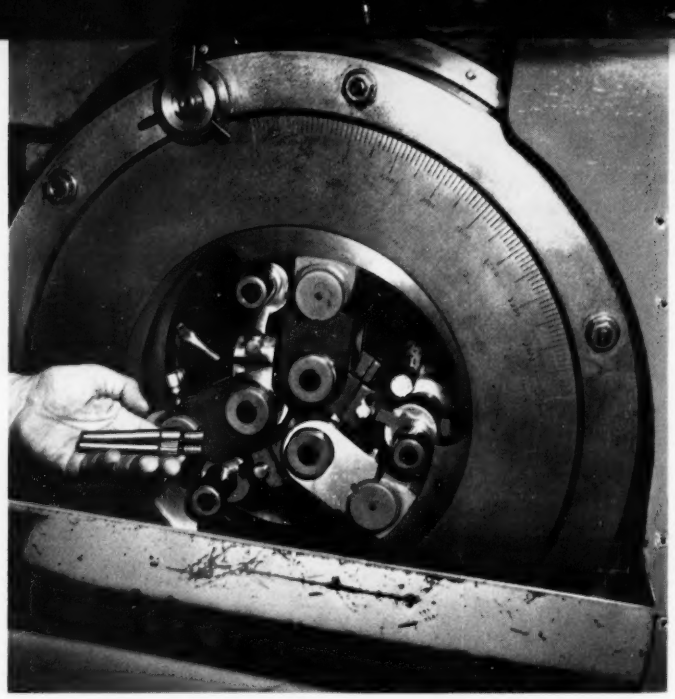
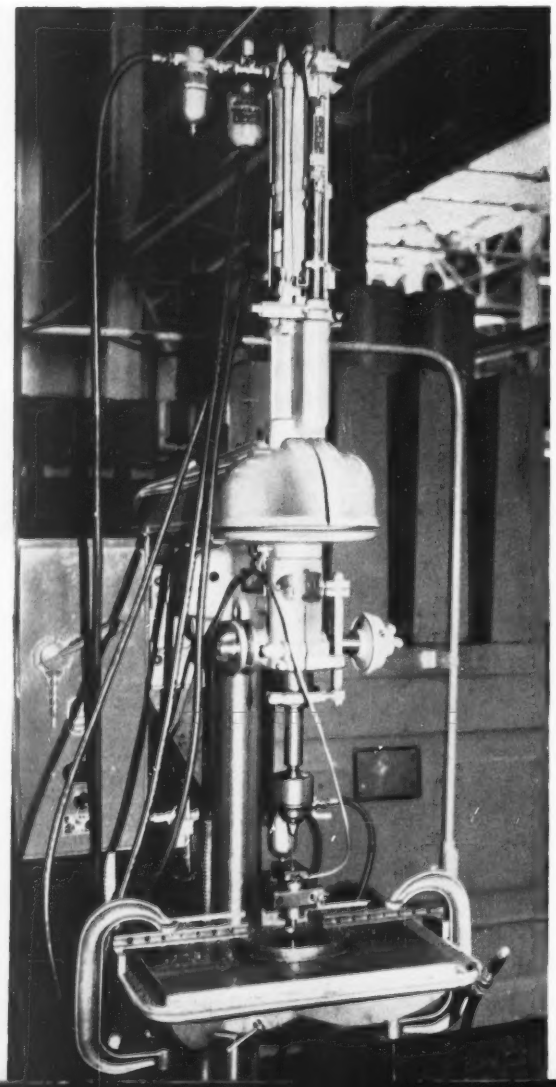


Fig. 13. Thread-rolling machines are used both for rolling threads and for producing splines, as in the example here shown.

trated in Fig. 6, about 0.0015 inch of stock being removed per side in this operation. Then the slide-valves are transferred to the Gisholt superfinishing machine shown in Fig. 7. A maximum of 0.0003 inch of stock is removed from the diameter to obtain a finish of 3 micro-inches r.m.s. Whereas hand-lapping formerly took two and one-half to three hours per piece to attain the required finish, the superfinisher does the job in forty-five seconds. Abrasive stones only slightly longer than the bearing surfaces are used.

The sleeves in which the slide-valves operate are finished on the Micromatic honing machine seen in Fig. 8, although the illustration shows a hydraulic cylinder being processed. On the valve sleeves, about 0.0025 inch of stock on the diameter is removed from a hole previously rough- and finish-bored. This machine is equipped with a Delpark filtering unit, as seen on the left-hand side.



Form-grinding on the piston of a hydraulic unit is shown being performed on a Jones & Lamson grinding machine in Fig. 9. The wheel is crush-dressed to produce the complete contour with one plunge cut. The same equipment is used for a variety of form-ground work.

Another grinding machine on which the wheel is crush-dressed is the Ex-Cell-O multiple-thread grinder shown in Fig. 10. The wheel feeds along the work after it has been fed to the thread depth. Threads are ground on such parts as cylinder heads, pistons, and large bolts.

Sundstrand milling machines are being used for a large variety of jobs, as many as 120 different cycles having been worked out. In Fig. 11, a vertical machine provided with two work-holding vises is performing a fast cutting operation on blocks of aluminum. One vise is being reloaded while an operation is in progress on work held in the second vise. Illustrated in Fig. 12 is a Sundstrand Rigidmil set up with a gang of four cutters for finishing horizontal engine mount fittings to the contour seen on the part tilted against the back of the work-holding vises. Dogs on the table operate solenoid valves which cause the milling head and cutters to rise and fall as the work passes beneath the cutters.

Bolts and studs of various types have their threads produced on a Reed thread roller, of which a close-up view is shown in Fig. 13. The same machine is employed to roll splines, such

Fig. 14. Single-spindle drilling machine which is equipped with a pneumatic head that provides for the deep-drilling of small-diameter holes

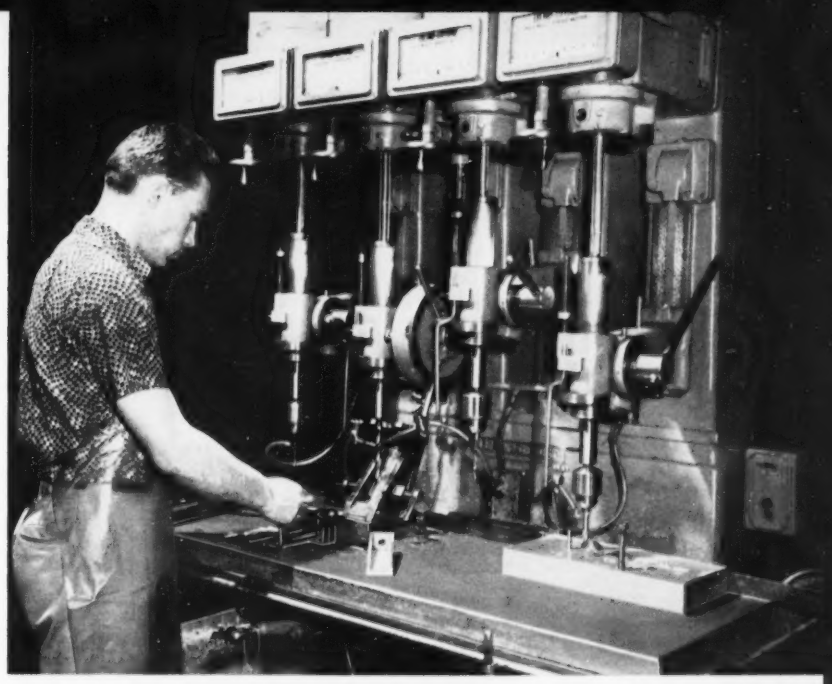


Fig. 15. Gang-drilling machines in a battery set up for performing a series of operations on the same part

as seen behind the threads on the work-piece being held by the hand in the illustration. Steel having a tensile strength of 180,000 pounds per square inch is rolled on this machine and threads meet the requirements of a Class 3 fit.

Deep-hole drilling is performed on the Delta single-spindle machine shown in Fig. 14, which is equipped with a general pneumatic feeding attachment. The operation consists of drilling four holes 1/8 inch in diameter to a depth of 4 inches in a part made from S A E 4130 steel. The drill reciprocates automatically during the operation to facilitate removal of chips and to insure straight holes. The reciprocations of the spindle for each inch of drilling can be varied.

Leland-Gifford gang-drilling machines of the type shown in Fig. 15 are employed in a number of instances where several drilling, reaming, counterboring, or tapping operations must be performed on the same work-pieces. In the operation illustrated, the part consists of an aluminum bracket which is mounted in a fixture that can be positioned at different angles beneath the drilling spindles to suit the individual steps of the operation. Spindle speeds from 450 to 1800 R.P.M. are available.

As previously mentioned, all operations on any part are performed as the work proceeds along the manufacturing line without the necessity of being shunted to another department. For example, the Ipsen heat-treating furnace shown in Fig. 16 is in line with a battery of machine tools. Work goes into one end of the furnace as it is transferred from a machine tool and is delivered hardened and tempered from the opposite end, ready for successive operations.

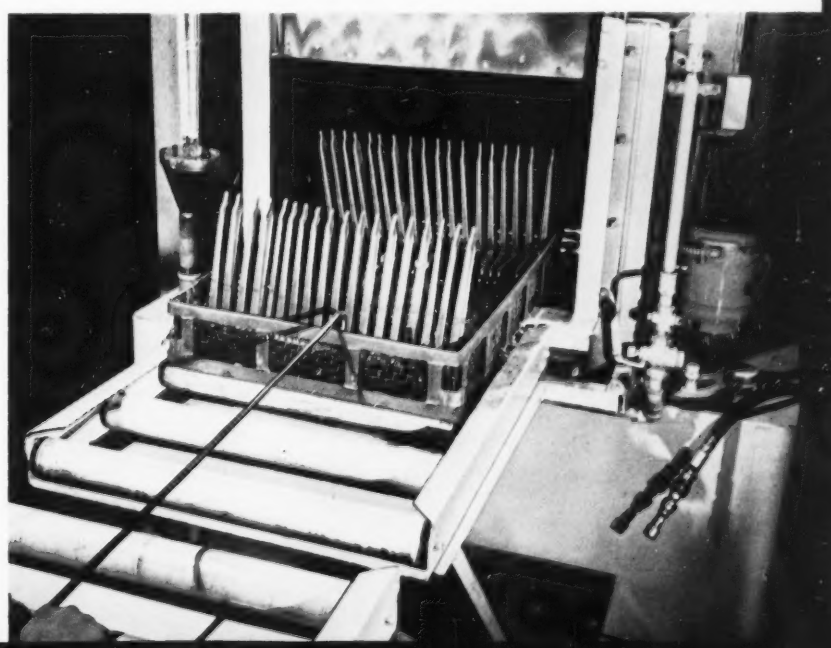
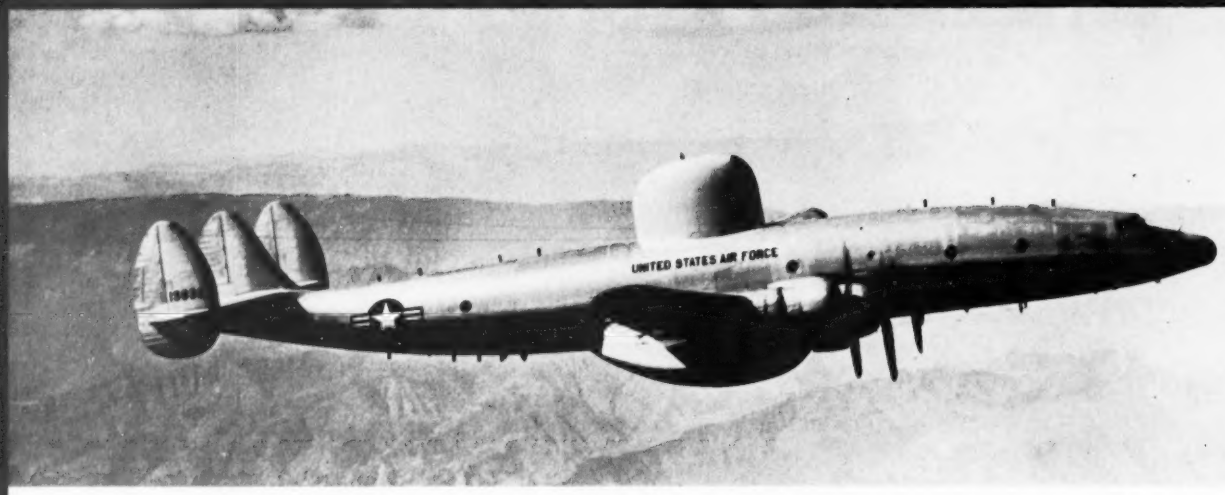


Fig. 16. Heat-treating furnace installed in the machine tool line in order to avoid the necessity of transferring work to a separate department

Lockheed Uses Epoxy Resins



Lockheed WV-2 Radar Equipped Flying Eye

The use of plastic tools in aircraft plants solved one material shortage in war days. Recently a new plastic has been adopted for this kind of industrial service

By G. J. WALKEY,
Manufacturing Research Engineer
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DURING the latter years of World War II, the Lockheed Aircraft Corporation, Burbank, Calif., pioneered in the use of plastic resins for various types of tools, such as punches, dies, stretch-form blocks, templates, and work-fixtures. Since then, tons of phenolic, ethyl-cellulose, and polyester resins have been used, but for the last six months epoxy resins have largely been applied for tools of the classifications mentioned. Epoxy resins are also being used as adhesives in building up fixtures from glass fiber and in forming certain products from laminations of glass fiber and other materials for use on aircraft.

Epoxy resins possess several qualities that make them especially desirable as a material from which certain tools can be made. For example, they are dimensionally stable and can be cured at room temperature. Therefore they do not require ovens or any other source of heat. By the addition of polymers, epoxy resins can be made flexible to almost any required degree. They possess high impact, flexural, and compressive strength, as well as good adhesive and non-corrosive properties. Laminations bonded with epoxy resins do not become brittle and therefore have a long service life. These resins are produced by several manufacturers under different trade names.

Epoxy resins are usually cast on other plastics, steel, Kirksite, or lead. They are generally cast in thicknesses of 1/2 inch or less for tool applications, because the exothermic heat generated in a mass would present certain difficulties if the resins were cast in greater thicknesses. They have a tendency to soften at temperatures above 250 degrees F. Also, they have a short pot life (the length of time they can be worked) and should be mixed in small batches which can be used within thirty minutes. The pot life can, however, be extended to around two hours. Epoxy resins are expensive

for Various Kinds of Tooling

in comparison with polyester resins, and it is for this reason that they are used generally as facings for various types of tools.

Another advantage of epoxy resins is that pure aluminum, either in powder form or in light flakes, can be added, usually in quantities of 25 per cent, to give the plastic the appearance of a metal. It has been found that shop men are completely without prejudice in regard to tools made of epoxy resins because they look as though they were made of metal. When these resins are used to "patch up" worn dies or to make changes in a tool, the plastic looks almost the same as the original material. Exceptional life has been obtained from epoxy-faced tools, and this warrants the greater cost.

Typical dies cast of Kirksite with epoxy faces 1/2 inch thick are seen in Fig. 1 on the bolster of the huge Birdsboro 8000-ton press in Lockheed's "Hall of Giants." These dies are used for door inner skins made from 24S-T aluminum alloy. These are the largest epoxy-faced dies that have been made so far.

In applying an epoxy resin to dies of this type, first the lead, Kirksite, or thermosetting plastic body is cast and then the plaster mold is raised 1/2 inch above the die surface and completely sealed with plaster. The epoxy resin

Fig. 1. Two epoxy-faced dies employed on a Birdsboro 8000-ton hydraulic press for forming door inner skins

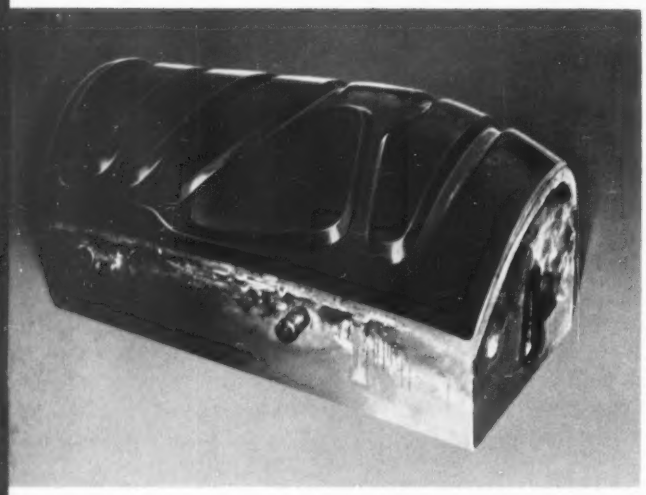


Fig. 2. Die consisting of Kirksite body faced with flexible epoxy resin for hydraulic press operations

is then poured through a gate into the space between the die and the plaster mold. In many cases, the punch is used instead of a plaster mold. No grinding or other finishing operation need be performed on the epoxy facing.

In mixing epoxy resins for tools of this type, Thiokol is usually added to give a certain amount of flexibility to the facing. This enables the same tools to handle sheet metal of various thicknesses—in fact, the difference in gage thickness may be as great as 0.100 inch. Basically, a soft die and hard punch are the result, which is advantageous in forming sheet metal with rubber sheets between the punch and die.

Another large die constructed for use under a hydraulic press is shown in Fig. 2. This die produces an inner liner for a door skin. The Kirksite body is faced with soft epoxy.

Plastic tools are being used widely under Cecostamps and rope drop-hammers. The punch and die in Fig. 3 are made of Kirksite with an epoxy facing, and the draw-ring of thermoplastic. The part produced is seen at the right.

A rather deep die of Kirksite with a soft epoxy facing, Fig. 4, is used in combination with a lead punch to produce a leading edge skin. The cavity is approximately 48 inches long, 10 inches deep, and from 5 to 8 inches in width.

A Kirksite drop-hammer die that had to be modified to suit an airplane model change is seen in Fig. 5. A substantial section of epoxy resin has been added to a depression at the back of the die to adapt the tool to meet the new design requirements. The appearance of the resin is practically the same as that of the parent metal.

Form-blocks of various designs are being used on Hufford and Sheridan stretch presses. One of the epoxy-faced form-blocks is seen in Fig. 6 on a Sheridan press, the body of the form-block being a thermosetting plastic. Solid tools for press brakes have been cast from epoxy resins, typical examples being shown in Fig. 7. In such applications, the flexible ingredients are omitted from the epoxy mixture. The practice is to cast these tools in long sections and cut

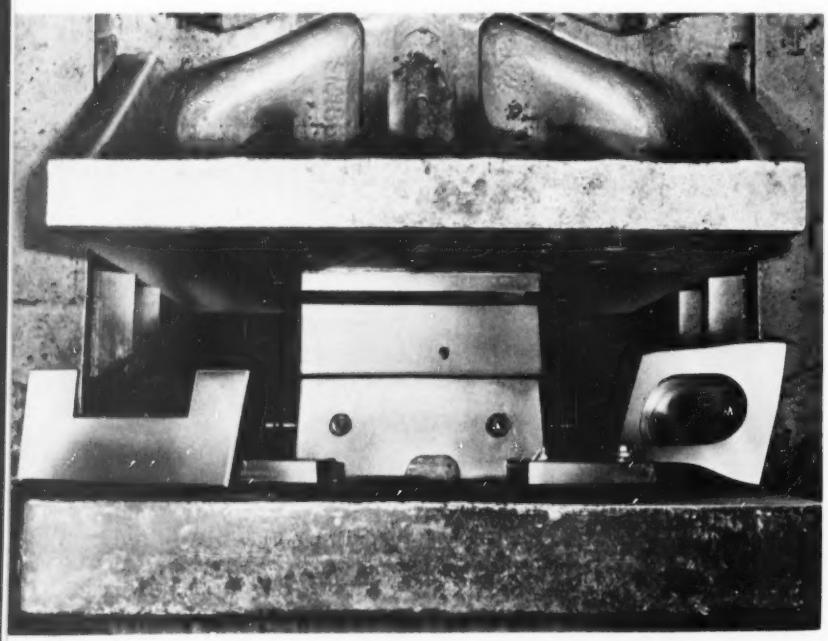


Fig. 3. Epoxy-faced dies are employed extensively in performing drop-hammer operations, as on the hammer here illustrated.

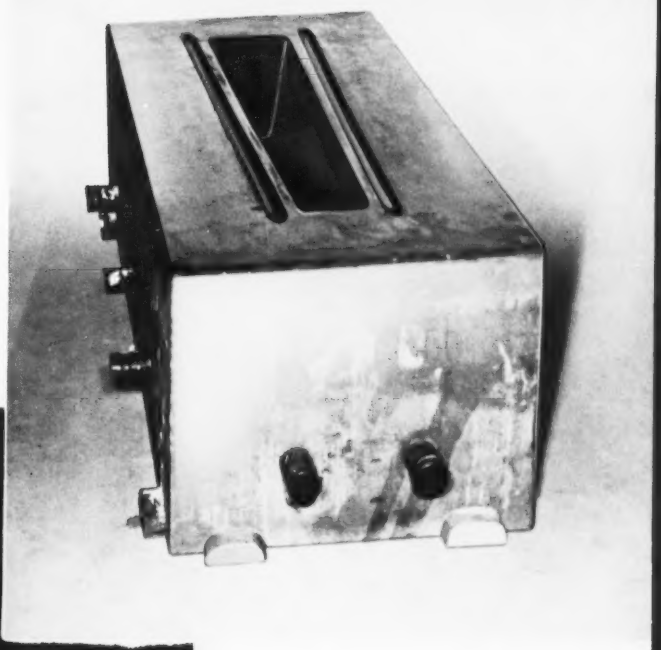


Fig. 4. Kirksite die with soft epoxy facing having a cavity 48 inches long by 10 inches deep and from 5 to 8 inches in width

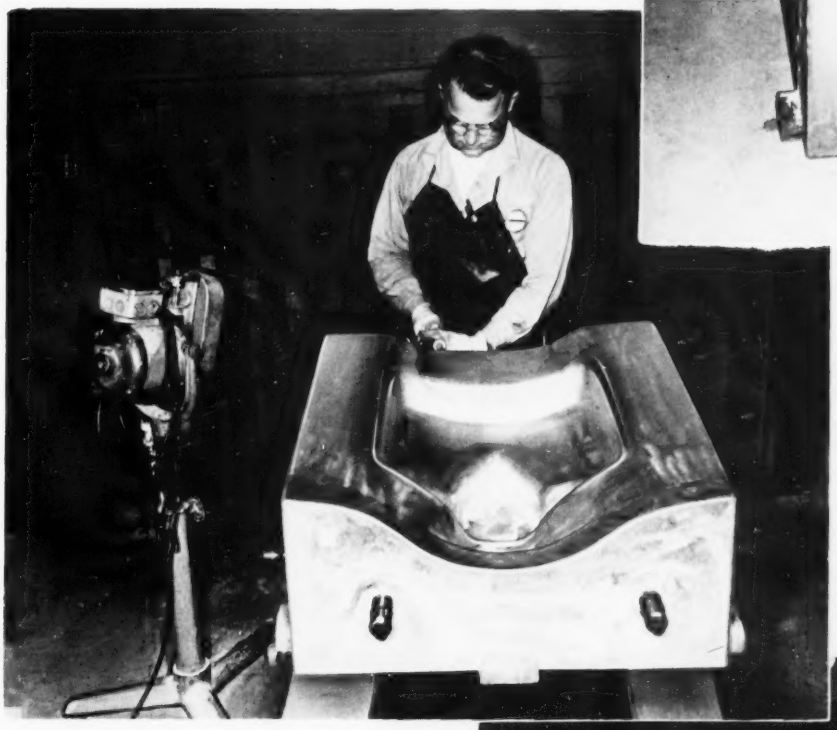


Fig. 5. Kirksite die to which a pad of epoxy resin has been added at one end to correspond with an airplane modification

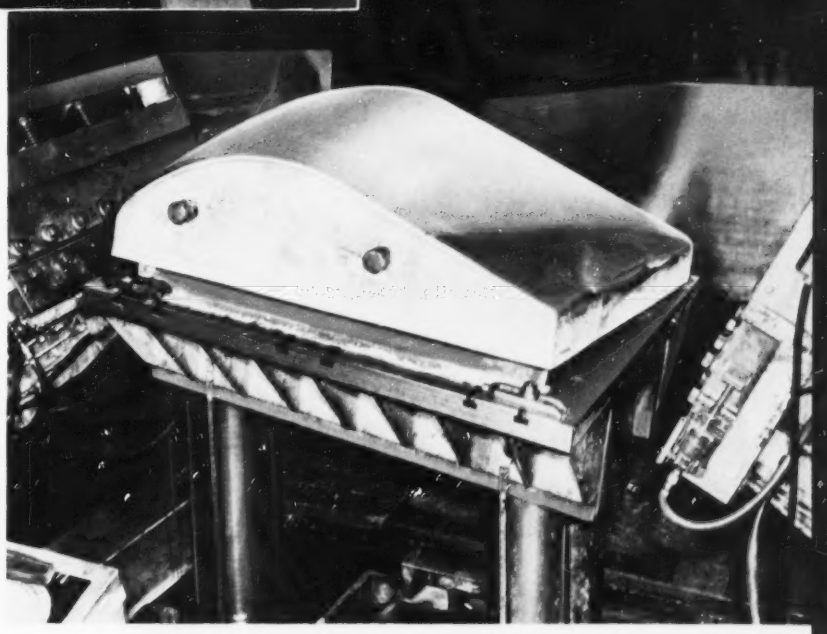


Fig. 6. (Right) Epoxy-faced thermoplastic form-block being employed on a Sheridan stretch press of the vertical ram type

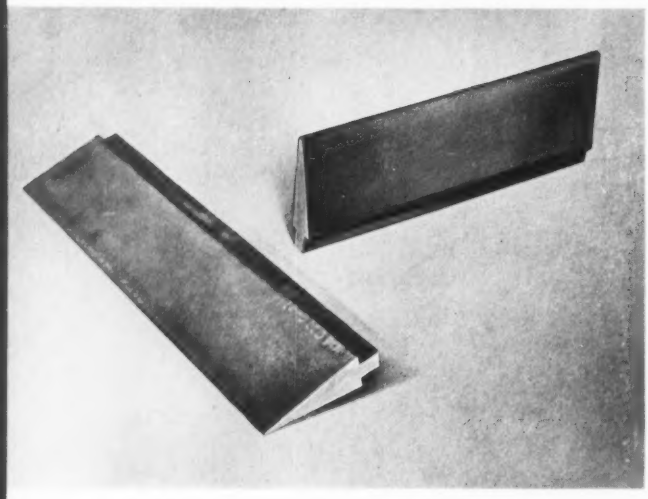


Fig. 7. Press-brake forming tools made solid from epoxy resin. No finishing is required to prepare them for service.

them to required lengths. The press-brake blades illustrated are approximately 4 inches wide. They do not require any machining.

Various fixtures and templates have been constructed of glass-fiber laminates bonded together with epoxy resins. In Fig. 8 is seen a large combination drill and router jig of this type, which was constructed for a wing tip tank. There are several openings for guiding a router tool, as shown, and a considerable number of drill bushings. Because epoxy resins are dimensionally stable, it is comparatively easy to locate the drill bushings within 0.010 inch and be assured that their accurate location will be maintained. The fixture illustrated is actually constructed of four sections. Another router fixture, or template, built up of heavy glass cloth and epoxy resin is shown in Fig. 9.

Epoxy resin pads are also used as locating seats on structural types of fixtures, of the type seen in Fig. 10. On the particular fixture illustrated, pads were provided along the straight inner surfaces at the top of the fixture and also across the curved surfaces. Because of the difference in the coefficient of expansion between the metal structural members and the epoxy pads, the pads were cut through at various points with a narrow band saw so as to enable greater expansion of the plastic parts.

Epoxy is also used widely by Lockheed in the fabrication of aircraft parts from glass fiber. In such operations, the glass-fiber sheet is draped over a die or other form and epoxy is applied in the same manner as polyester resins.

Parts fabricated in this manner are being used as housings, junction boxes, ducts, and other components where high strength is not a factor. Formerly, such parts were made from aluminum sheet, but the glass-fiber components are even lighter in weight and far less expensive. Complicated shapes can be produced in one piece.

Fig. 8. Combination drill and router jig for a wing tip tank constructed of laminations of glass fiber bonded by epoxy

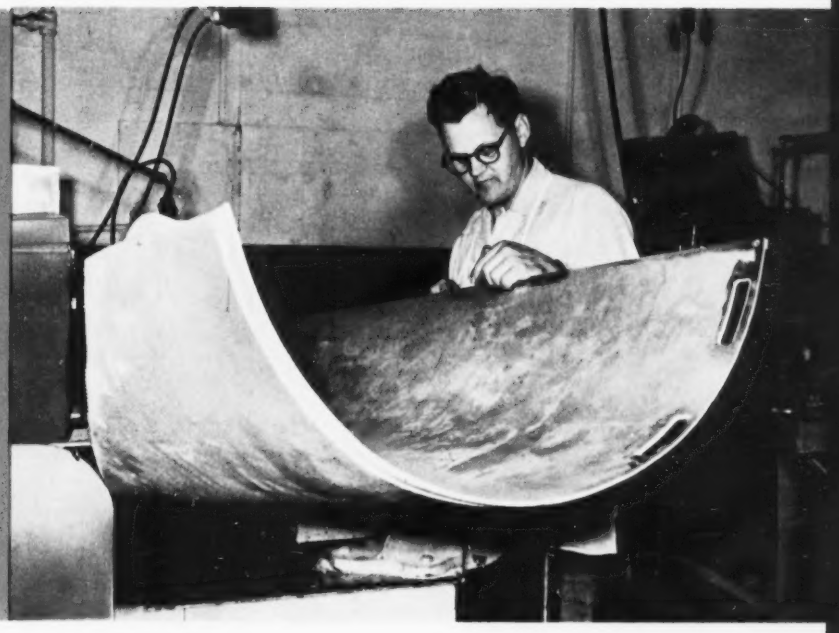


Fig. 9. Another router fixture, or template, constructed of a heavy glass cloth reinforced with epoxy resin for shape permanency

Large radomes, which are attached to the outside of airplanes, are also made from glass fiber impregnated with epoxy. On one plane, the tail is equipped with an antenna that must be separated from the fuselage. The antenna is attached by means of an epoxy section.

With regard to the radomes and the antenna connections, it is important to note that the United States Air Force considers any part on the outside of an airplane as a structural member. The glass-fiber parts impregnated with epoxy are considered strong enough for such applications. The adhesive properties are so good that it is difficult to split the plies built up from glass-fiber sheets and bonded with this type of resin.

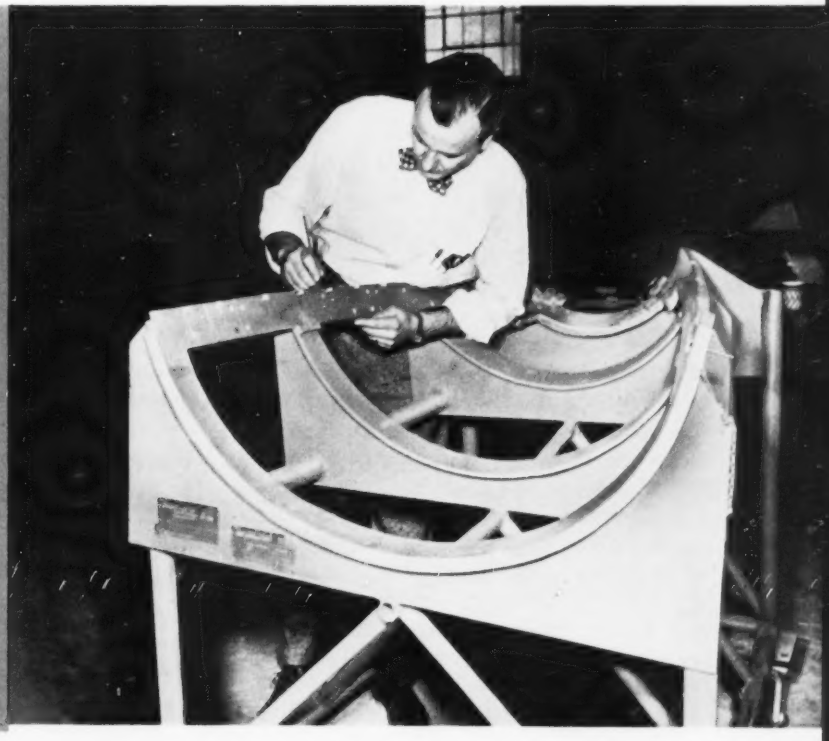
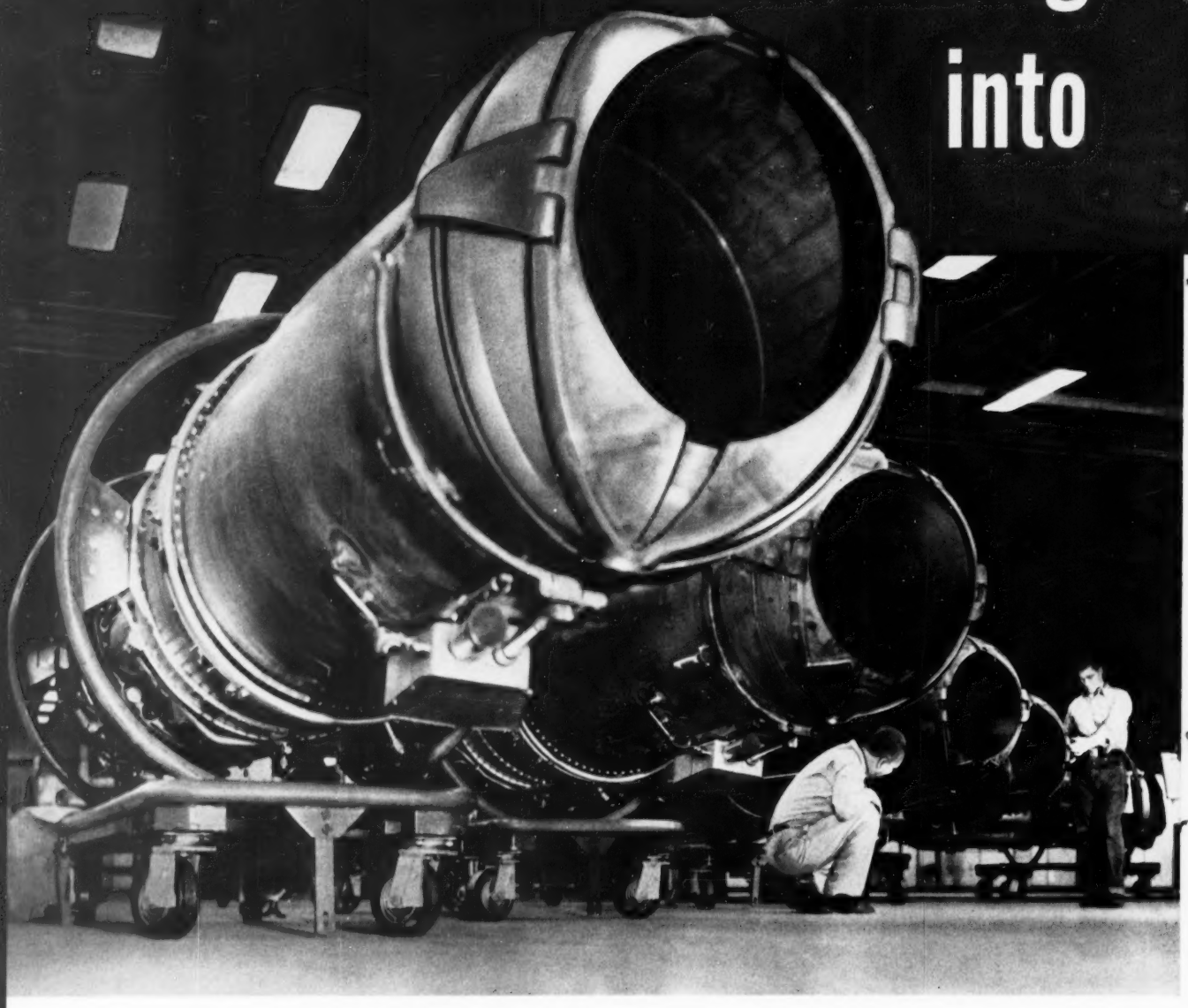


Fig. 10. Structural type of fixture for an aircraft part on which all work-locating surfaces are faced with epoxy pads

Fabricating into



Manufacturing methods used by the Ryan Aeronautical Co., which specializes in producing the "hot end" components of jet engines. Welding, machining, and heat-treating operations are described in this article

By LAWRENCE LIMBACH

Vice-President—Manufacturing
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High Temperature Metals Jet-Engine Afterburners

AFTERBURNERS are the jet-engine components that help make it possible for aircraft to operate at supersonic speeds. They instantly consume the fuel that is injected into them and greatly augment the thrust developed by the consumption of fuel in the combustion chamber. Jet engines with afterburners have exerted a thrust equal to 20,000 H.P. at top flight speeds. With the same static thrust as a larger, heavier engine not provided with an afterburner, a plane equipped with this component has twice the rate of climb, is lighter in weight, and has an equal or greater radius of action. Incidentally, there are airplanes today that use fuel in quantities as great as 2000 gallons an hour.

Temperatures as high as 3700 degrees F. have been recorded for the flame in the combustion chamber and afterburner of jet engines. Such temperatures are approximately 1000 degrees F. hotter than the melting point of the highest heat-resistant alloys that can be fabricated into jet-engine components, a condition which has presented unique design problems.

By constructing combustion chambers and afterburners in such a way that the combustion flame is centered in each component and that a blanket of cooling air is provided between the flame and the inner wall of the component, the actual working temperature of the metal walls is held to between 1200 and 1800 degrees F. These temperatures are well within the melting points of a number of metals. For high-temperature operation, however, there are several other requirements that must be met by the fabricated metals.

Specifically, oxidation resistance, corrosion resistance, and high-temperature strength are the most important requirements. Probably the most vital is the ability to resist oxidation, because the structural strength of a metal becomes unimportant if the metal rapidly burns away. At the operating temperature of jet engines, ordinary steel burns almost like paper while tungsten, molybdenum, and columbium oxidize quickly, as do most alloys of high melting point.

The Ryan Aeronautical Co. uses twenty-seven different high-temperature alloys in fabricating the components of jet-engine power plants. They may be classified into the following four groups: chromium-nickel steels, chromium steels, nickel-base alloys, and cobalt-base alloys. Afterburners are largely constructed from Inconel X, Inconel W, and Multimet.

Welding is an Important Factor in the Fabrication of Afterburners

The afterburners are fabricated largely by welding, and unique methods have been developed for performing the welding processes. For example, by equipping a Taylor-Winfield spot-welding machine with a fast indexing mechanism, gas-tight seam welding can be performed at a speed of 20 inches per minute, as compared with from 6 to 12 inches per minute before the installation of the special equipment. Spot welds on 1-inch centers can be made at the rate of sixty welds per minute, in contrast with the former rate of twenty-one per minute.

High-temperature metals are poor heat conductors, and for this reason the actual welding speed must be limited. Otherwise the metal will crack. By developing a fast electrode drive, which stops at each spot weld to hold pressure, welding operations have been accelerated.

Roll spot-welding is performed with wheel type electrodes which roll and stop for the shortest possible time necessary to make a sound weld. Indexing the electrodes a distance of 1 inch be-

Fig. 1. Welding machine with control that enables spot- and seam-welding operations to be performed at unusually high speed

tween spot welds is accomplished in the minimum time. The flexibility of the equipment permits the indexing time to be varied to suit different types and thicknesses of material.

The mechanism is an air-operated, electronically controlled unit consisting of two horizontally opposed bellows that actuate an overriding clutch. Powered by standard air-line pressure, of 80 pounds per square inch, the clutch operates the upper electrode roll. By simply operating a switch, the electric seam-welding drive can be disconnected and the roll spot-welding drive set for action, or vice versa. Spot welds can be made at any spacing from 0 to 5 inches.

Certified gas-tight seams are obtained in Inconel W by overlapping spot welds at a spacing of five and one-half welds per inch. In Fig. 1 is shown one of the Taylor-Winfield machines equipped with the special welding mechanism, although the work happens to be a jet-engine tail-pipe rather than an afterburner part, on which a roll spot-welding operation is being performed. A huge 120,000-ampere Federal welding machine is used to join the nozzles to afterburners, as illustrated in Fig. 2. The bottom electrode roll may be seen inside the work in the operation shown in Fig. 3. A view of the special equipment for fast roll spot- and seam-welding is presented in Fig. 4.

Inert gas-shielded arc welding is employed for a variety of parts, including the nozzle section for the afterburners. On the Heliweld machine illustrated in Fig. 5, a nozzle section is being welded along an irregular joint as electronically controlled motors actuate horizontal and vertical movements of the welding head.

In Fig. 6 is illustrated a fixture that facilitates the accurate location of reinforcing strips on an afterburner part. This fixture is readily portable to any shop location. A Seedorff suspended welding machine with long arms that enable spot welds to be made deep within cylindrical sections is seen in Fig. 7, being used on the "eyelid" section of an afterburner. A counterbalance reduces operator fatigue.

Both continuous seam welds and Heliwelds are apparent on the afterburner unit illustrated in Fig. 8, this part being fabricated from Multimet. In Fig. 9 can be seen the intricacy of an afterburner section which contains a large number of spraybars for injecting fuel into the afterburner through a myriad of tiny jet holes in small tubes.

Several of the more important machining operations performed on afterburner components

Fig. 2. Nozzle is welded to afterburner on huge welding machine which can exert 11,000 pounds of force.

include the turning, boring, and facing of flanges mounted on the opposite ends of the afterburner fuel injection cone. This operation is shown in Fig. 10 being performed on a Bullard vertical turret lathe. The flanges are rings of Inconel W which cannot be machined as fast as stainless steel, the cutting speed being approximately 200 surface feet per minute and the feed, 0.008 inch. About 1/16 inch of stock is removed from all surfaces and they must be machined to a finish of 63 micro-inches r.m.s. Diameters are held to plus 0.010 inch, minus 0.000 inch, while the faces must be flat and parallel within 0.005 inch. A large afterburner ring is seen in Fig. 11 being finished on a King vertical boring mill.

Eighty holes are drilled in each flange of the cone and in the engine components that are attached to it. The holes are drilled twenty at a time on the Natco multiple-spindle drilling machine shown in Fig. 12. The holes are 0.277 inch in diameter. Every other hole on one-quarter of the circumference is drilled at one time, after which the work is indexed in its fixture for drilling the holes in between. Then the work is indexed approximately 180 degrees for drilling the holes on the opposite side, in two steps. Four indexings are performed to complete the job.

The drills used for this operation are "thinned" in the web. This reduces the pressure required to feed the drill through the flanges. The included angle of the lip is also specially ground. Incidentally, the drill head is constructed with two sets of spindles mounted in groups so arranged that, by operating a cam, one set can be positioned for the operation on the cone flanges; and by shifting the cam, a second set of drills can be positioned to meet the requirements of an entirely different job.

Precise alignment of the bearings on the opposite ends of the movable eyelids is insured by rough- and finish-boring them on a special machine of the type illustrated in Fig. 13. These machines are provided with a Hydro-Borer unit at each end. The bearings are made of Multimet and are machined with Carboloy 883 tool bits. A feed of 0.004 inch is employed and a cutter speed of 300 R.P.M. The total tolerance is 0.003 inch.

Accurate locating of the work is insured by means of sliding plugs which are entered horizontally into the rough bearings of the eyelid before the clamping devices are actuated to grip the work. After clamping, the locating plugs are withdrawn prior to making the cuts. The bearings are previously welded to the sheet metal.

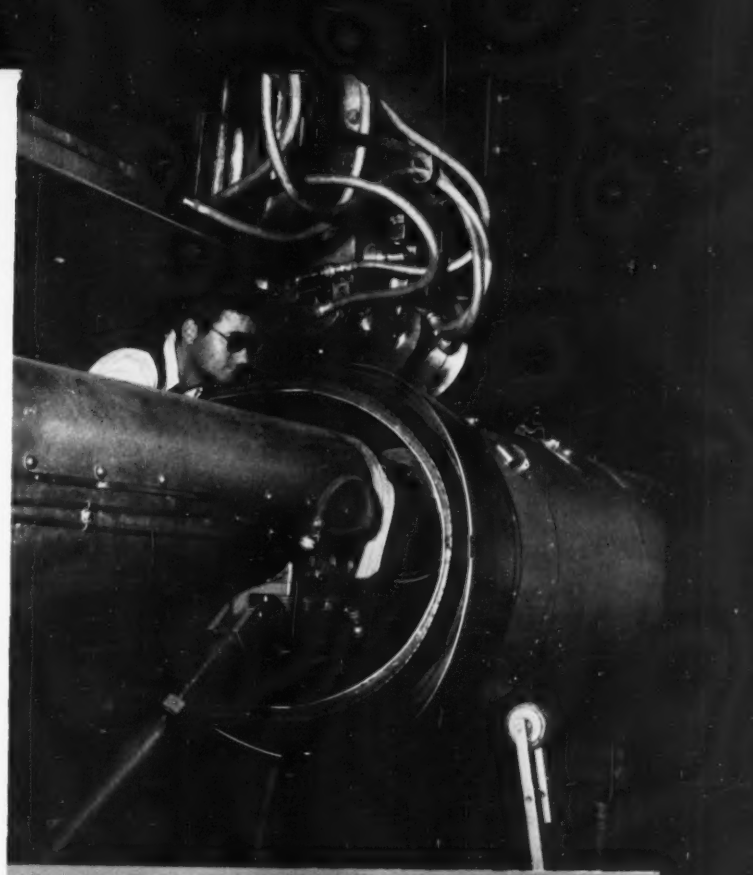

Fig. 3. View of the welding machine seen in Fig. 2, showing the arrangement of the bottom electrode roll, which extends 60 inches

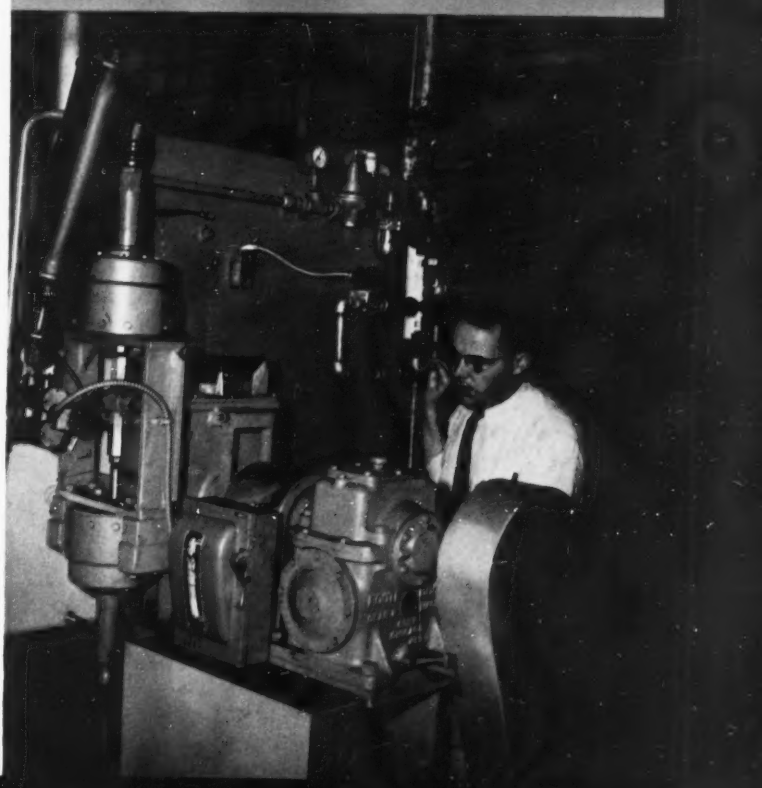

Fig. 4. The equipment on the roll spot- and seam-welding machine which has speeded up the welding of afterburner components

Fig. 5. Nozzle section for an afterburner being welded on a machine arranged with automatic movement of the welding head horizontally and vertically as it follows a contour

The yokes that operate the movable eyelid after assembly are finished on the Cincinnati milling machine shown in Fig. 14. Two front bosses are milled on each side and also the central boss, but not the intermediate bosses. Next the yokes are drilled on an American radial drilling machine, an operation of considerable interest since, although the tolerance on the center distances is plus or minus 0.010 inch, this tolerance is difficult to obtain because of the awkward shape of the yoke. There are three different sizes of holes.

When the afterburners have been completely assembled, they are stress-relieved in the special furnace seen in Fig. 15 which is so constructed

Fig. 6. Ingenious portable fixture which facilitates the location of reinforcing strips around an afterburner section

Fig. 7. Spot-welding machine equipped with arms which facilitate operations to be performed on inaccessible cylindrical parts

Fig. 8. An afterburner ignition assembly made of deep-formed and welded Multimet

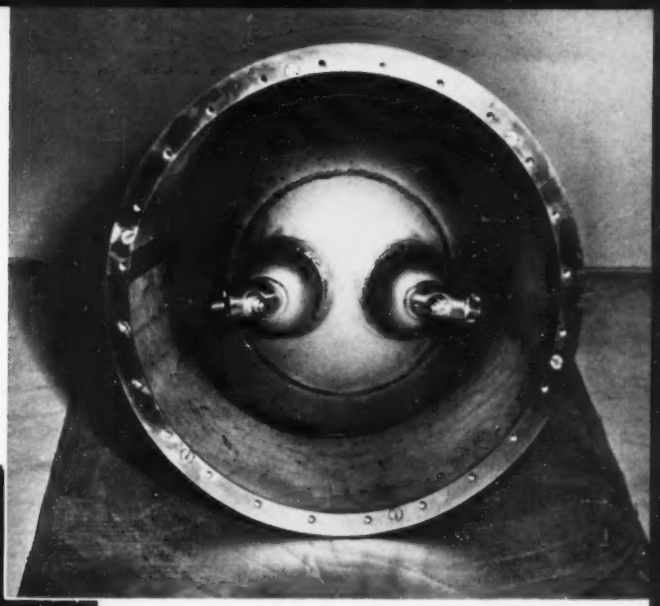

Fig. 9. (Left) Illustration which shows the intricacy of a typical afterburner fuel injection section fabricated primarily by welding

Fig. 10. Turning, facing, and boring the flanges of an afterburner section on a vertical turret lathe

Fig. 11. Machining a large afterburner ring on a vertical boring mill prior to assembly of the ring

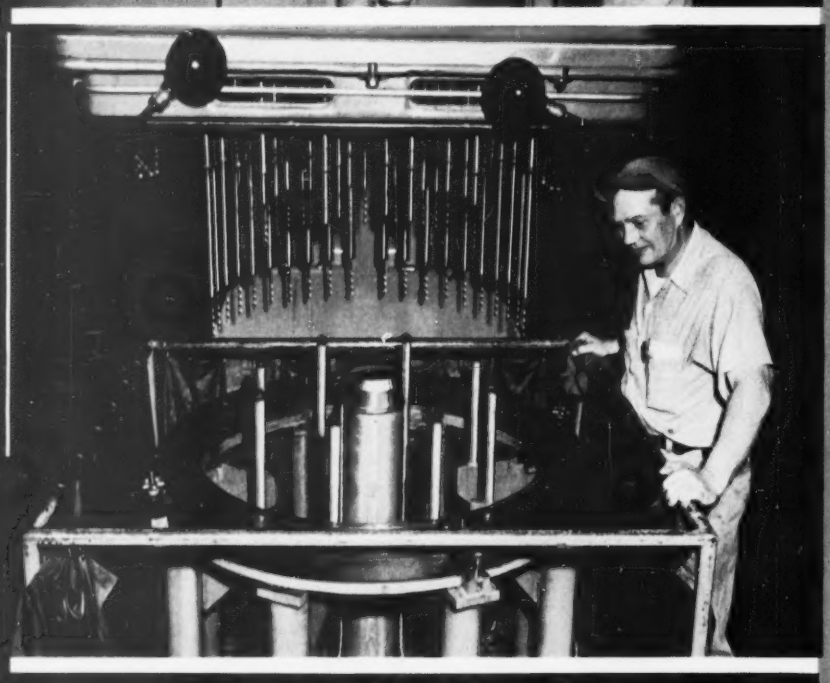

Fig. 12. Eighty holes are drilled around each flange of the afterburner cone and mating members, in four steps that involve indexing of the work

Fig. 13. Special Ryan machine equipped with hydraulic boring heads for the accurate finishing of bearings at opposite ends of the movable eyelid

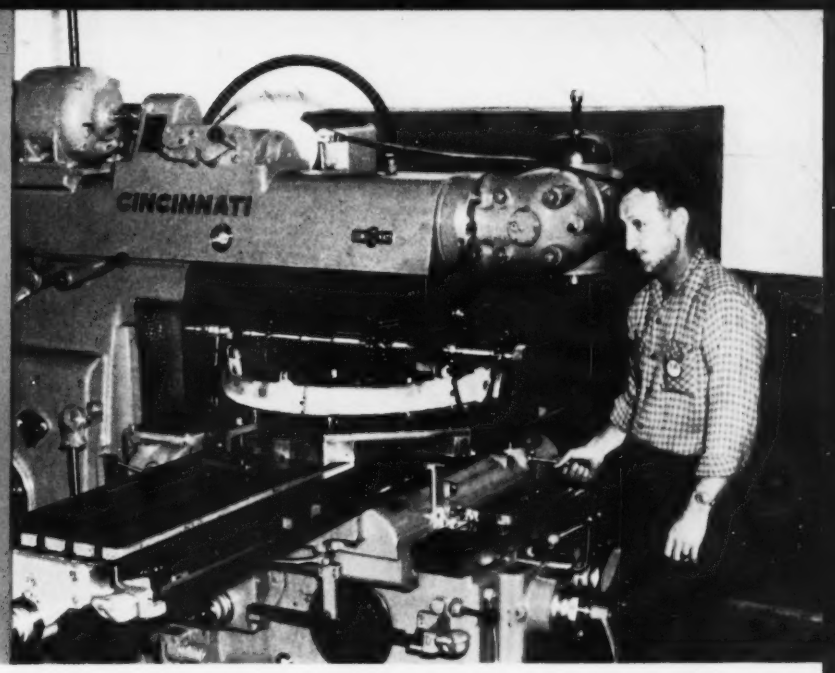

Fig. 14. Milling bosses on the ends and in the center of yoke which operates movable eyelid

that the heat-treatment can be effected without any dimensional changes in the work. No scale occurs in the heat-treatment, just a slight discoloration. Afterburners are heated to 1450 degrees F. and aged for two and one-half hours. Then the temperature is allowed to drop at the rate of 450 degrees an hour until the furnace reaches a temperature of 500 degrees F. The afterburners are then removed from the furnace and allowed to cool in the shop atmosphere.

Heat-Treating Furnace of Unique Construction

This large gas-fired furnace was designed as a brick-lined structure without a bottom and with a front door entry. In a concrete pit directly in front of the furnace, two mobile cars can be loaded from adjacent floor level platforms. By means of a hydraulic piston, these cars are switched from the loading platforms to a center track which leads into the furnace. Three afterburners are loaded on each car for the operation. After the afterburners are rolled in, electric motors hoist the cars 6 inches to seal the furnace floor. A heavy steel sliding door closes the compartment.

Although this furnace is not completely of the controlled-atmosphere type, satisfactory regulation of the atmospheric condition is maintained through an ingenious combustion arrangement. The gas burners are located along the top of the furnace sides. Air and gas are injected separately into a special combustion chamber at the top of the furnace. Only sufficient air is provided to support combustion so as to avoid excess air that might cause oxidation.

The hot gases are forced down into the heating compartment through openings in the firebrick ceiling. The gas is circulated through the afterburners, passes through ducts in the floor, and rises in the furnace walls to again enter the combustion chamber. In addition to stress-relieving, this furnace accomplishes age-hardening of the alloys used in the afterburners.

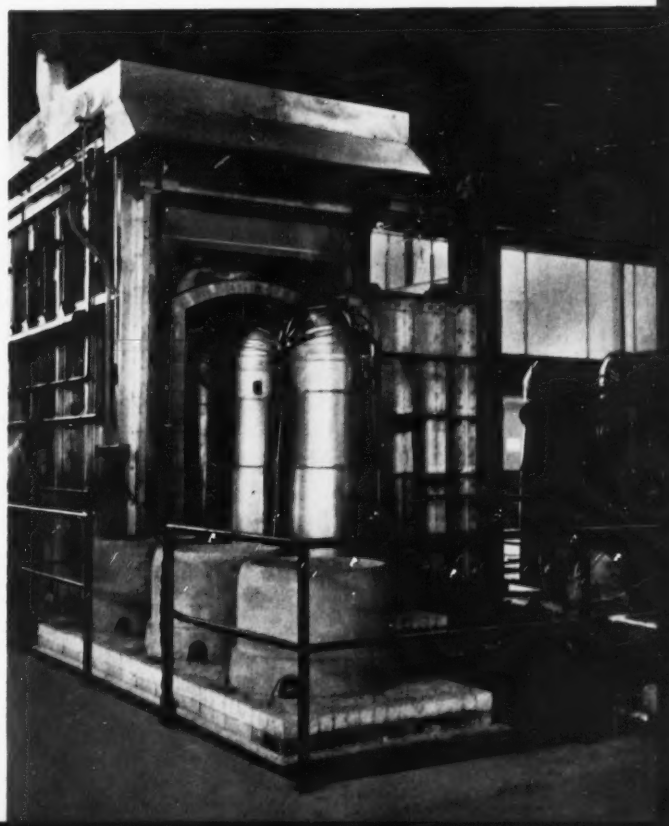

Fig. 15. Afterburners are mounted three at a time on flat cars for the stress-relieving and aging operation which is performed in a gas-fired furnace.

Compass Manufacture Typifies Diversity of Sperry Operations

By CARL A. NISTRON
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A SMALL canister-like object, less than 7 pounds in weight and deceptively simple in external appearance, houses the highly intricate mechanism of the "S-3" Gyrosyn compass. This instrument is an important element of the airplane automatic pilot system and the gyromagnetic compass system produced by the Sperry Gyroscope Co., Division of the Sperry Corporation, Great Neck, N. Y.

The device combines the functions of a directional gyro and a navigational compass, having its orientation in azimuth "slaved" by a flux valve installed in the wing tip or in the top of the vertical fin of the airplane. The flux valve detects the direction of the lines of force of the earth's magnetic field and transmits this information electrically to a signal transformer coupled to the compass. Actually, the heart of the compass gyro is the rotor of an induction motor driven at 24,000 R.P.M. that spins about a horizontal axis to provide a stable directional reference. The gyro housing is free to revolve on horizontal bearings in a gimbal ring, which, in turn, revolves around a vertical axis in a stationary housing.

Any difference between the indicated and the magnetic headings varies the voltage of the signal transformer selsyn. A variable transformer pick-off detects the angular movements of the aircraft relative to the gyro. In the automatic pilot system, these pick-off signals are amplified and fed to a servo motor that moves the rudder to provide directional stabilization of the airplane. In the slaved gyromagnetic compass system, these signals are fed to a heading indicator on the pilot's control panel. Here, the rudder is operated manually.

Since the accuracy and responsiveness of the compass mechanism require a severe limitation on the amount of free drift allowed the gyro, manufacturing tolerances are extremely small. Shaft sizes are held to within 0.0001 inch, and bored holes to between 0.0001 and 0.0002 inch for proper fit with coded (sized) bearings.

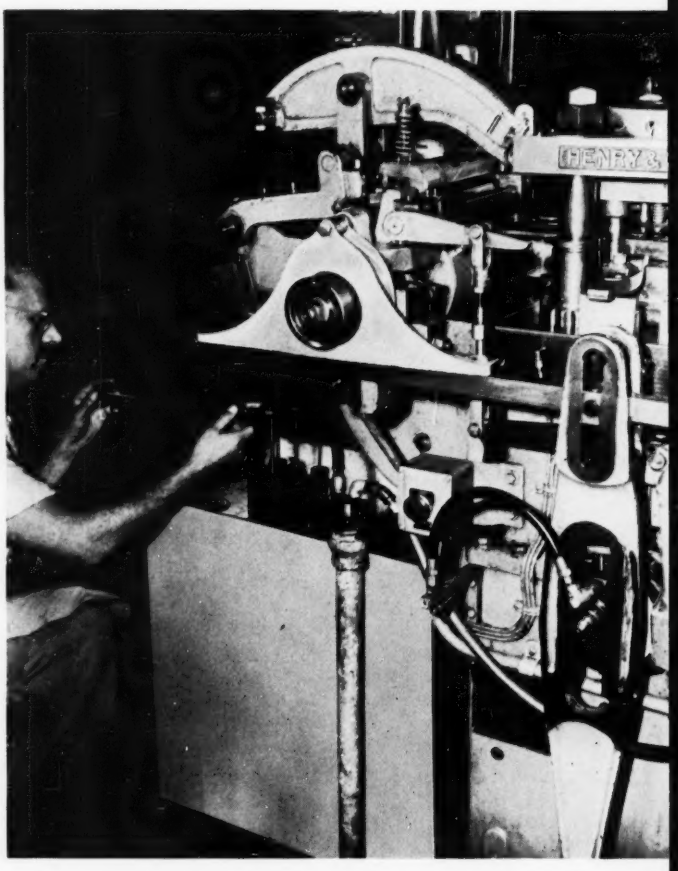
Rotating members are delicately balanced. Inspections constitute a substantial number of the thirty-five operations which the average detail part undergoes. In the assembly area, temperature and humidity are closely controlled, with every precaution taken to keep the work practically surgically clean. Highlights in the production of the rotors and stators for the compass, featured in this article, indicate the scope of the manufacturing operations involved.

Producing laminations for the rotors and stators of the gyro starts in the press department. Rolls of high-permeability alloy metal and silicon steel sheet are first slit into suitable widths, then stamped and deburred. Many of the stampings are made on Henry & Wright dieing machines. In Fig. 1 is shown the discharge end of one of the 25-ton machines. A five-station progressive die, together with an integral, automatic roll feed, gives a production rate of 6000 laminations per hour. In the illustration, the operator is shown stacking the laminations on a rod while removing them from the discharge chute.

Stampings are deburred by being fed through the two machines seen in Fig. 2. Each machine consists of two Hammond bench sanders. The upper sander is inverted and fitted with an abrasive belt. The lower sander is fitted with a plain leather belt. One motor drives both sanders, but in opposite directions; the abrasive belt runs toward the operator, and the leather belt runs away from him. Laminations are fed through the belts, burr side up. The leather belt, acting as a carrier, causes the laminations to travel toward the rear of the rig to an inclined table, then drop onto a stacking rod. The operator can observe the condition of the stacks through a large mirror supported at an angle in a frame above the table.

An annealing cycle of seventy-two hours increases and stabilizes the magnetic property of the laminations. First, the laminations are automatically conveyed through a Detrex degreaser,

Fig. 1. Removing a stack of laminations from an automatic stamping machine



where they are washed with a trichloroethylene agent. This is a force spray, at 150 degrees F. Next, the parts enter a vapor chamber, where they are dried at a temperature of 650 degrees F. in a one-hour cycle.

The laminations are then spread out in stainless-steel trays, which are blanketed with aluminum oxide and stacked in stainless-steel boxes. Before being placed in the furnace, covers are arc-welded onto the boxes to form a pressure-tight unit. This operation is illustrated in Fig. 3. The covers, made of mild steel, are burned off upon completion of the cycle and the boxes are re-used. A means of controlling the atmosphere within the box is provided by pipes extending from one end of the box, which are accessible from the outside of the furnace.

The box is first heated to between 600 and 650 degrees F. It is held at this temperature for one hour, at which time nitrogen is introduced into the box in order to expel all air. The nitrogen, in turn, is then purged by hydrogen, maintained at a pressure of 5 pounds per square inch and a flow rate of 5 cubic feet per hour, and the temperature is then raised to approximately 1200 degrees F. At this point nitrogen is fed directly into the furnace itself to prevent excessive oxidation of the box. The charge is raised to 2050 degrees F. in a period of eighteen hours, then held at this temperature for four hours.

In cooling, the process is reversed, with nitro-

Fig. 2. A leather belt serves to advance the work to the inclined table of the sander.

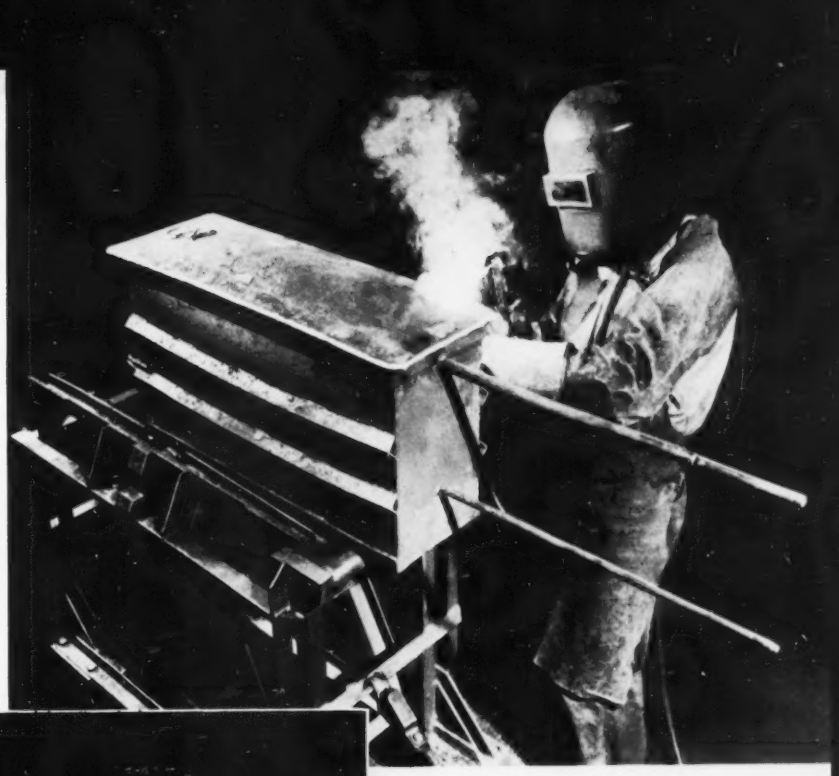


Fig. 3. Welding the cover to a stainless-steel annealing box. Boxes are re-used for several annealing cycles.

Fig. 4. (Left) Using a gage, the operator quickly selects a stack of approximately fifty-one laminations.

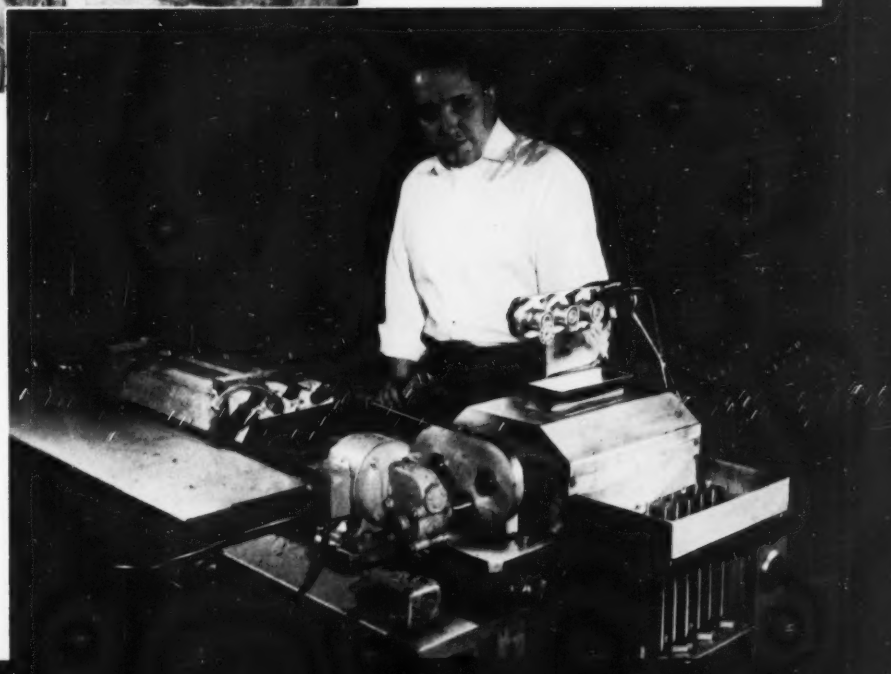


Fig. 5. This special machine automatically dips the laminations in cement and then conveys them through a drying tunnel.

Fig. 6. Coil-winding of the stacks is performed mechanically where stator slots are externally located.

gen purging the hydrogen from the box at 300 to 400 degrees F. before air is again introduced. Because magnetic properties are greatly affected by proper annealing, the procedure is highly important. In fact, the operation of the Gyrosyn compass depends considerably on the condition of the lamination material.

For the rotors of the compass, the laminations are stacked and pressed together, as shown in Fig. 4, then bound with aluminum in a die-casting operation. The operator employs a gage to select the required number of laminations (approximately fifty-one, in this instance), moving them forward on the stacking arbor. The front of the arbor has a spiral-fluted section, corresponding to the internal profile of the laminations. This pattern is continued on a detachable stud fastened to the end of the arbor.

As the laminations are slipped onto the stud, they automatically become skewed to the desired helix. The stud, with the stack intact, is then removed and nested in the fixture seen in the background. This fixture is bolted to the bed of a Denison 10-ton hydraulic press. On the down stroke of the ram, precisely limited by a dial indicator, the stack is compressed, and the stud ejected and replaced by a cylindrical casting plug. The casting plug diameter is 0.0015 inch greater than the stack bore, so that it has a force fit and maintains the compressed condition of the stack during the die-casting operation. Several stacks and plugs are visible on the fixture.

In die-casting, the stacks and plugs are placed in a mold in a Lester-Phoenix machine. Molten, pure aluminum is injected into the mold, filling the helical spaces around the plug and forming a

Fig. 7. A tray of ball bearings is placed in the chamber where the lubricant is applied in the form of mist.

solid shell of metal about the stack. The die-casting is performed at high pressure, 20,000 pounds per square inch, so that the required density of material is assured. After subsequent machining of the stack, the plugs are removed and re-used.

Laminations used for coil-wound stators go through a Cycleweld process involving cementing, stacking, and baking operations. Application of the cement, illustrated in Fig. 5, is performed automatically on a special machine. A suction arm picks up three parts at a time, releasing them over a bath of a special thermo-setting cement. From the bath, the parts are conveyed through an infra-red drying tunnel. Laminations are then stacked and locked in clamping fixtures, and fused together in a large oven under pressure.

Coil-winding of the stators is intricate and exacting. Where the slots in the stacks are internal, the winding is done by hand. However, where the slots are external, the stacks are wound on Globe machines. One of these machines is illustrated in Fig. 6. Once the operator positions and indexes the stack, the winding is automatic. The machine will come to a stop when a pre-set number of turns have been completed. After the ends of the wires are soldered to terminals and the coils tested for continuity, the windings are carefully compressed to blueprint specification in a special fixture. Varnish impregnation follows, with a subsequent baking under vacuum for sixteen hours.

Ball bearings for the Gyrosyn compass are carefully inspected, cleaned, and re-lubricated in a dust-free, air-conditioned area. Bearing torque

Fig. 8. (Above) Inside diameters of rotors are finished in the Bore-Matic department to receive the lamination stacks.

Fig. 9. (Below, left) The "Bearingising" operation compresses and burnishes surfaces that seat ball bearings.

Fig. 10. (Below) The arm of the friction wheel is momentarily lowered into contact with the rotor in order to accelerate it.

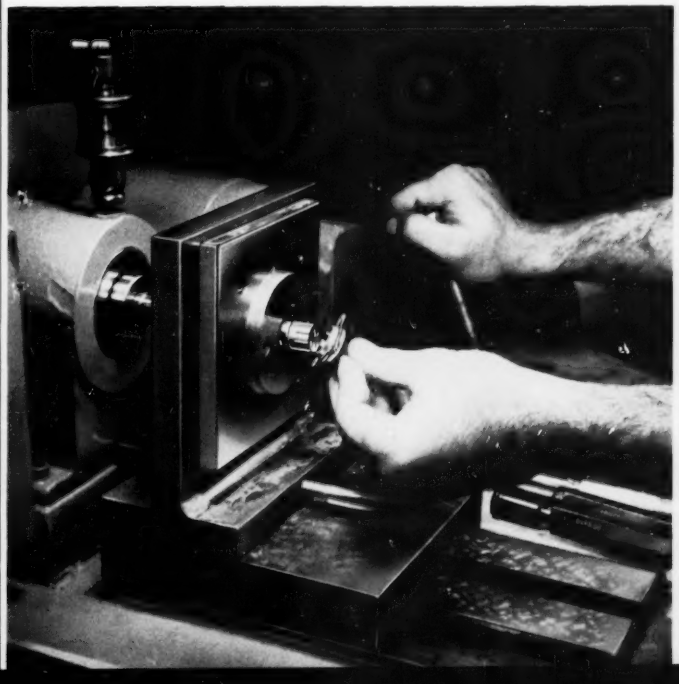


Fig. 11. Filling the grease reservoir in the gyro housing. The grease is applied by a click type gun.

is checked on an ingenious Sperry-designed instrument. With the bearing supported in a flat position, the outer race is driven by a small motor at 2 R.P.M. A wire calibrated for a specified torque is suspended from a plug inserted in the inner race. At its lower end, the wire carries a brass thrust load. In twisting the wire in a direction opposite to the rotation of the outer race, a circuit to a signal light is closed. As long as no greater friction torque exists than that in the twist of the wire, the light remains on, and the bearing is acceptable.

Bearings are cleaned either in a solvent spray or a degreaser. All low-torque bearings are lubricated in a mist chamber, Fig. 7, constructed by the company. Here, oil is filtered, pumped, and atomized into the chamber in a controlled cycle so that each bearing has the proper amount of lubricant. Bearings are then sealed in containers and stored.

Typical of the precision machining operations involved in compass production is the finish-boring of rotors, illustrated in Fig. 8. The extensive machine shop area is arranged "colony" style, all finish-boring work being handled by a battery of Heald Bore-Matics. To permit dynamic balancing of the finished rotor, the run-out between the bores and the outside diameter must be held to 0.0005 inch or less. The diameters shown being bored house the rotor laminations. The spring collet, standardized in design for the entire department, is bored in place on

Fig. 12. Two of the stations in the Gyrosyn room. One of the assemblers is using a vacuum hose to clean a part.

the machine to the finished outside diameter of the rotor to minimize the amount of run-out.

Internal diameters that seat ball bearings in the Gyrosyn compass are accurately sized by "Bearingizing," as illustrated in Fig. 9. Here, the part in work is a bracket for a rotor bearing. A Cogsdill tool performs the operation. The device consists of a mandrel in which rapidly revolving cams hammer a series of loose-fitting rolls against the bore diameter. The peening, in compressing and burnishing the work surface, enlarges the diameter slightly. Each piece is gaged and coded in steps of 0.0001 inch.

Bearing journals in the gyro housing are also sized. These members are lapped on a semi-automatic pivot polishing machine, then gaged and coded. Selective assembly with the correspondingly coded ball bearings is thus possible.

Rotors are dynamically balanced at high speed in their own bearings on Strobodyne machines, one of which is shown in Fig. 10. The friction drive of a motorized rubber wheel rapidly accelerates the rotor. Positions of unbalance vibrations causing even infinitesimal displacements are detected and indicated in terms of drill depth. Balancing holes are drilled on the special Hamilton sensitive machine seen on the operator's left.

In assembling the rotor and its bearings in the gyro housing, 70 milligrams of grease, carefully measured, is first packed in a small reservoir next to the bearing retainer. This operation is illustrated in Fig. 11. The assembler uses a special click type gun, dispensing 3 milligrams of the lubricant with each click. Rotor and bearings are then inserted, and the housing is sealed.

Final assembly, adjustment, and testing of the instrument are performed in the Gyrosyn room. Here, unusual precautions are taken to safeguard the purity of the air. The room has its own air-conditioning system, and is kept under a slight pressure to reject outside air when doors are opened. A special oil-impregnated sponge rubber door mat removes minute particles of dust from shoe soles. Work-benches are waxed weekly. Only lint-free wiping cloths are used. Vacuum hoses are used to clean work.

The various work stations are set up in lines on both sides of conveyor belts. The belts advance the work from station to station at eleven-minute intervals. A view of two of the stations in the line is shown in Fig. 12. In the foreground, the run-out of the compass dial is being checked. At the other station, the gimbal housing is assembled. Compasses move along the belt seen in front of the workers. A plastic dome protects the instrument during the intermediate assembly stages.

At another station, Fig. 13, the leaf contacts that connect the torque motors are being straightened behind a magnifying glass. The position of all leaves must be such as to support a weight between 15 to 21 grams, thereby minimizing the amount of friction.

Activities at other stations include assembling of tuning condensers, checking and adjusting scale error, static balancing and adjusting for excessive drift check, and calibrating rotors and stators to each other. Careful control of the instrument along the line is provided for by an accompanying inspection tag.

In the final test, shown in the heading illustration, four instruments are strapped to a table. With the gyros running at operating speed, the table simulates the yaw, roll, and pitch of the airplane during its flight.

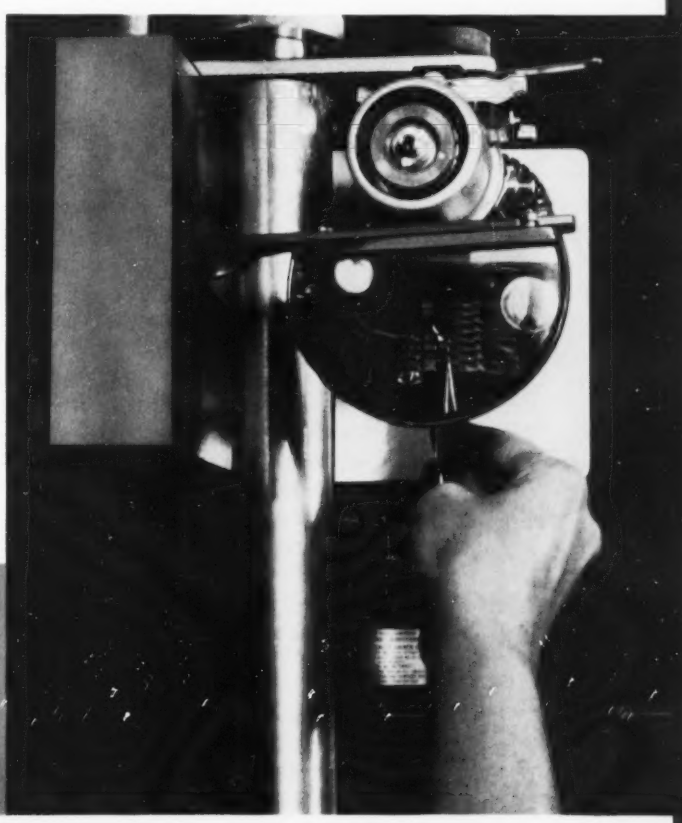


Fig. 13. Contact leaves are tested by employing weights and straightened behind a magnifying glass.

North American's Present

North American F-86 Sabre Jet

Since the first Hydroform was put in service for the production of sheet-metal components, it has come a long way in its range of work. A larger machine, as here described, is now used for complete forming operations, as well as either preforming or final forming alone

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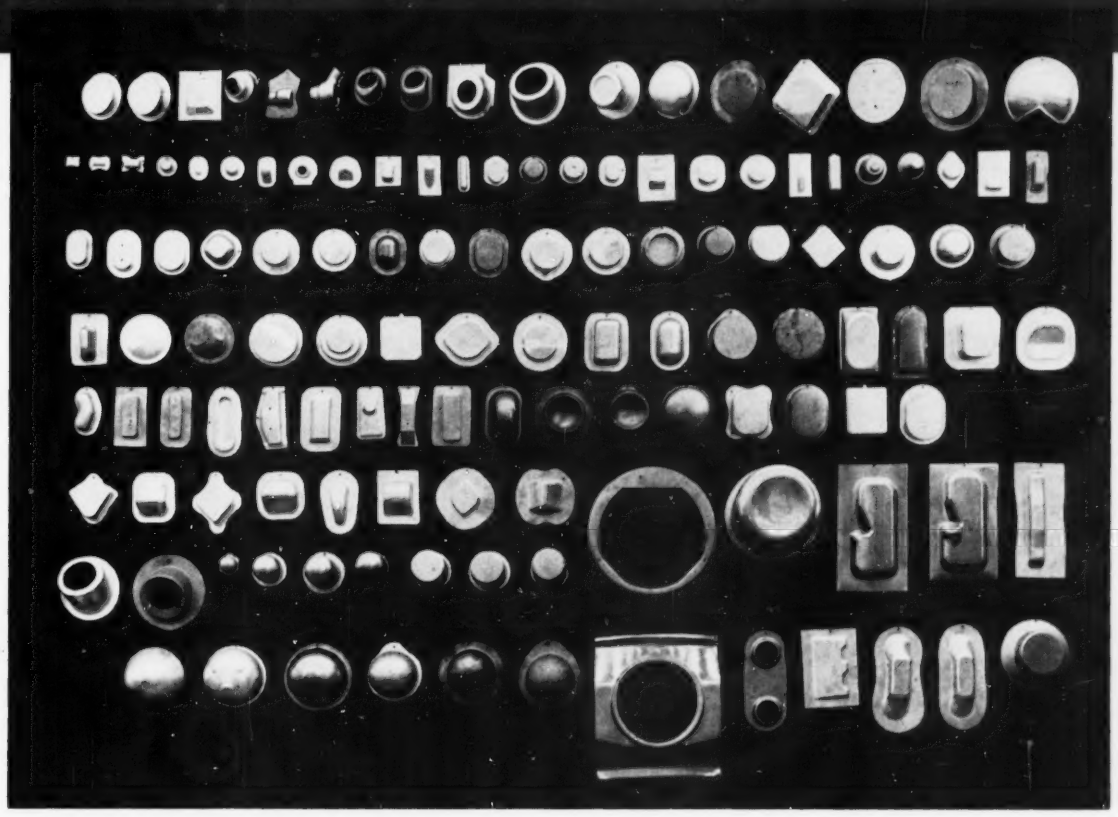
HYDROFORMING has unquestionably established its place in the shops of North American Aviation, Inc., Inglewood, Calif., as an important process for the production of aircraft sheet-metal components since the appearance of an article in October, 1951, MACHINERY, which covered early experiences with this type of metal forming. Parts of diversified configurations can be turned out by this method at a faster rate, with lower tooling costs, and with higher standards of quality than were possible with methods long considered standard in the airframe industry. Typical examples of the variety of work produced by the Hydroforming method may be seen in the heading illustration at the right.

A recently installed machine having a capacity for parts up to 26 inches in diameter is shown in Fig. 1. This machine was built by the Hydroform Division of the Cincinnati Milling Machine Co. It incorporates a vertically moving dome *A*, in the bottom of which a cavity has been machined. A rubber diaphragm, also called a flexible die member, is stretched across the open end of the cavity and seals the cavity. Hydraulic fluid is pumped into the space above the diaphragm at controlled pressures up to 8000 pounds per square inch to effect Hydroforming after the dome has moved down into the forming position. The dome is locked in this position by four interlocks *B* which automatically move into contact with strain rods *C*. These interlocks eliminate the need for a high-tonnage hydraulic hold-down system to overcome the high pressure that is built up in the dome during forming.

The lower portion of the machine contains a bolster plate *D* through which passes a fastening stud for a vertical punch. Tooling for the form desired consists of only two pieces—the punch, which is attached to the punch fastening stud by means of a drift pin, and a draw-ring containing a through hole of a mating contour to the punch, and through which the punch rides. The draw-ring rests on a steel nesting ring

Hydroforming Practice



(sometimes called a draw-ring support), which may be used on a variety of jobs depending on the outside diameter of the punch employed. Selection of a nesting ring which will result in a minimum of internal draw-ring overhang is essential, as pressures directed against this overhang reach 15,000 pounds per square inch in some forming operations.

In the initial phase of the forming operation, the punch is positioned flush with the top of the draw-ring, and the metal blank is placed centrally on these members. The dome is first lowered to its forming position, following which the interlocks are automatically actuated to retain the dome in place. As a result, the diaphragm is sealed around the outer periphery of the draw-ring. The cavity is then charged with hydraulic fluid under sufficient pressure to force the rubber diaphragm against the blank. This is done to prevent wrinkling of the metal during the forming cycle. The initial charge is an important factor in realizing satisfactory forming results, and may be set at any pressure up to 8000 pounds per square inch.

While the metal blank is being held under the selected pressure, the operator actuates the punch control lever, thereby causing the punch to move upward on a forming stroke. The application of the punch force in an upward direction against the pressurized diaphragm, together with the reaction of the incompressible hydraulic fluid against the cavity side of the diaphragm, causes the metal to draw in around the formed punch. As the operation progresses, displacement of area in the dome cavity causes higher forming pressures to develop against the top, radius area, and side walls of the formed part. Hydraulic pressures up to 15,000 pounds per square inch can be generated in this manner.

Forming pressures can be varied or selectively controlled at any stage of the forming operation by adjusting the pressure-regulating cam, an integral part of the automatic operating cycle unit shown at *E* in Fig. 1, and also in Fig. 2. Close

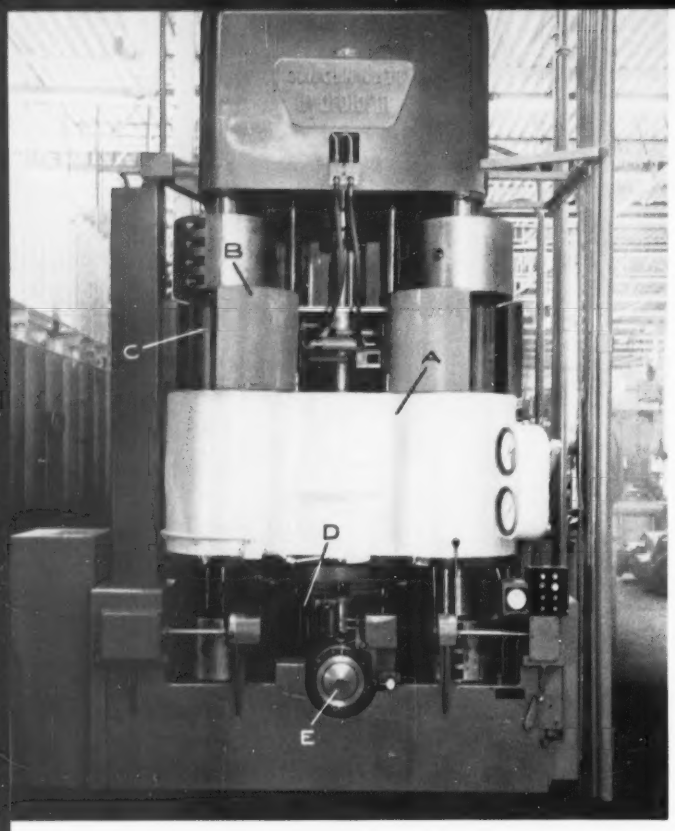


Fig. 1. Large Hydroform will handle parts up to 26 inches in diameter. A pressurized cavity, by means of which forming is accomplished, is located within dome (A).

control of the form depth, dome charge (which may be varied when additional pressure is required during any phase of the forming cycle), dome charge stop, and strip stop may be had by adjusting this unit. The purpose of the strip stop is to halt the punch at any desired point on its downward stroke.

When a new die is received, trial-and-error methods are employed on a few expendable pieces of stock so that the proper settings for the graduated automatic cycle unit can be established. The settings are then recorded on a special form in conjunction with material type, gage, grain direction, and other pertinent information. This recorded data will facilitate duplication of pre-established pressures, speeds, draw depths, and other variables at any future scheduling of a given part.

Edging, or sharpening the drawing radius of the work-piece, can also be controlled by a cam stop on the automatic operating cycle unit. To edge a part after it has been drawn to the desired depth, the punch is retracted slightly while the machine is closed and the dome cavity is under pressure. The effects of edging may be clearly seen on the lower radius of the right-hand part shown in Fig. 3 as compared with the unedged part on the left.

Although the Hydroform principle can best be applied to forming over-size sheet-metal blanks into flanged cups, spherical domes, rectangular recessed covers, and a variety of configurations in this category, the field has recently been expanded to include many different operations. One of these is the forming of developed flat patterns. First, the parts are either blanked out or profiled to their developed contour and several manufacturing holes are pierced or drilled. Then the blanks are placed on the draw-ring of the Hydroform in such a position that matching pins on the punch pass through the manufacturing holes in the part.

From this point, normal operation of the ma-

Fig. 2. This automatic operating cycle unit is adjustable to allow the press to fulfill all necessary requirements for satisfactory forming of the blank.

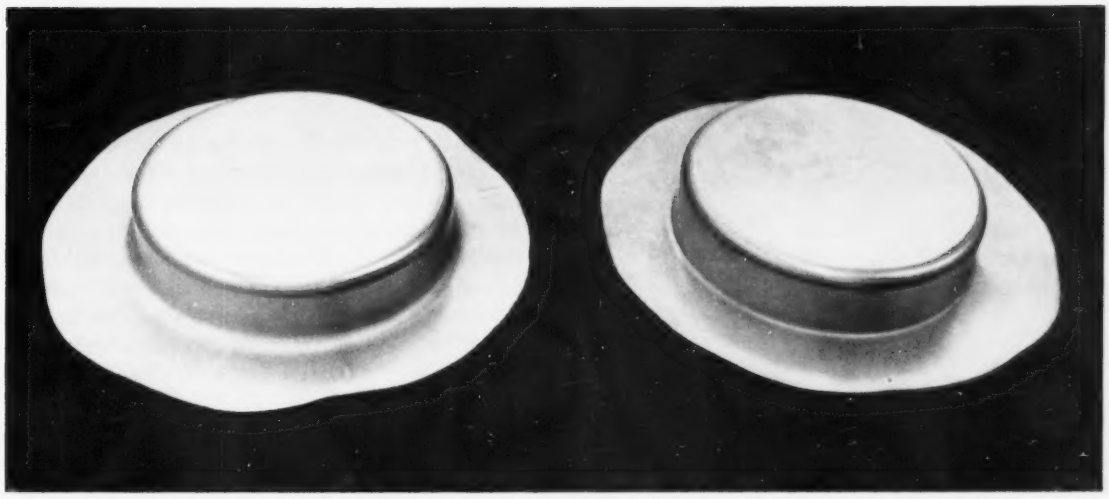


Fig. 3. (*Above*) *An edging control cam is provided on the automatic operating cycle unit. This control permits the sharpening of the lower radius* (*right*), *as compared to the unedged part* (*left*).

Fig. 4. (*Left*) *Forming of developed flat patterns is a common operation on the Hydroform. The blanks are located on the punch by means of pins.*

Fig. 5. (*Below*) *The part at the right has been preformed on a drop-hammer to be subsequently finish-formed as seen at the left. A cast Kirksite draw-ring* (*center*) *is shown with punch abnormally raised.*

Fig. 6. "Blow-down" die (top) is employed to preform blank (bottom) for subsequent forming into a complex shape.

chine will produce a finish-formed product. Parts fabricated in this manner from 0.040-inch thick blanks of 75S-O aluminum may be seen in Fig. 4. The nesting ring, draw-ring, and punch are shown. One part is located on the punch with the locating pins protruding through the manufacturing holes. A high standard of quality was realized in the manufacture of these parts, in addition to the satisfactory production rate of 55 pieces per hour.

Besides carrying out complete forming operations normal to its own field, the Hydroform is often called upon for partial operations. By this is meant such operations as preforming a part which will subsequently be finished by other forming mediums. An example of reverse situation is illustrated in Fig. 5. In this case, the blank at the right was preformed on a drop-hammer, and that at the left, completed on a Hydroform. Although ordinarily not a difficult operation for a drop-hammer, this particular flange is critical with respect to the tolerances of the inside diameter and the flange bow. Tooling consists of a Kirksite draw-ring, cast to the desired completed shape of the part, and a punch machined from hot-rolled steel.

To realize full advantage, in diversified operations, of the initial charge obtainable in the dome, a solid lower platen was built. This converted the original machine into a hydraulic, rubber-pad forming press having a capacity of 8000 pounds per square inch.

If higher pressures are required when using conventional hydraulic press form-blocks, a variation of the solid lower platen may be employed which utilizes the vertical ram movement. In this variation, a circular platen—which is in theory a large flat-top punch—is designed for attachment to the ram. Form-blocks are located on this platen, and the dome is lowered, locked, and charged in the normal manner. The ram is then actuated to raise the movable platen, with the form-blocks in place, into the pressurized diaphragm. Displacement in the dome cavity caused by the upward flexing of the diaphragm raises the internal pressure as high as 15,000 pounds per square inch.

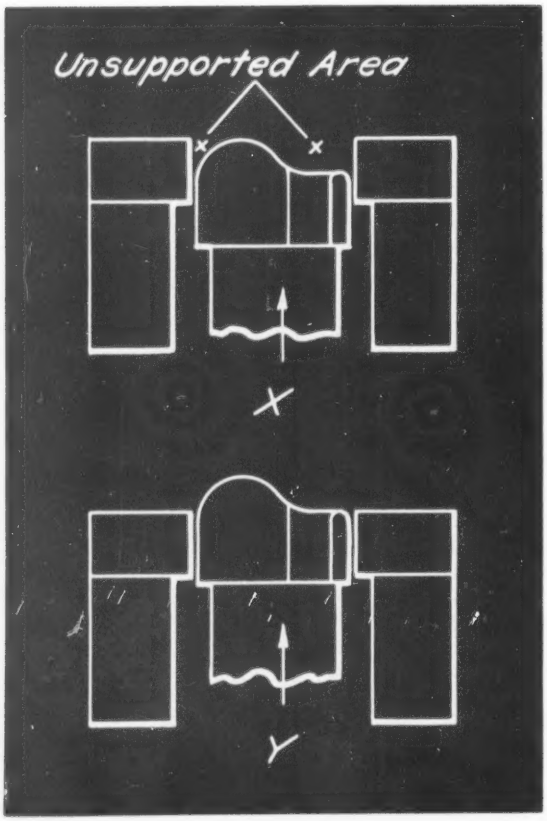


Fig. 7. Punch located as seen at X, leaves large unsupported area when using flat blank. With a preformed blank, the punch can be raised, as seen at Y, to support the work prior to final forming.

Fig. 8. Work-piece (bottom) was finished by the draw-ring and punch (top) after being preformed as shown in Fig. 6.

The high pressure of the initial charge is particularly adaptable to "blow-down" operations, in which, as the name implies, material is forced down into a specially shaped cavity in a shallow-cast Kirksite die. An economical blow-down die, such as the one shown at the top in Fig. 6, is usually employed as a preliminary forming tool when the shape of a conventional Hydroform die would result in excessive unsupported areas.

If a sheet-metal detail having a top surface formed of compound curves were to be Hydroformed in a single operation, the initial charge would have a tendency to force the material down into the unsupported areas, shown at X in Fig. 7. This would be especially true with light-gage materials. However, the punch may begin its forming stroke from a raised position, shown at Y, when the stock is preformed on a blow-down die, thereby eliminating most of the unsupported area and permitting a satisfactory completion of the forming cycle. The final draw-ring, together with the movable punch, may be seen in the upper part of Fig. 8. In the lower part of the illustration, may be seen the completely formed work-piece.

Pressures exerted by most Guerin process hydraulic presses used in the airframe industry are not great enough to form an under-cut flange without the use of special cam-action dies or considerable hand finish-forming. This process is used in a preforming operation to yield the 0.064-inch thick, 24S-O aluminum part shown at the left in Fig. 9. A form-block, seen at the right, is used in conjunction with a solid lower platen on the Hydroform to easily wrap the flange of the part under. The completed part may be seen in the center of the illustration.

Fig. 9. Part at the left was formed on a rubber-pad hydraulic press. A flange was wrapped under (center) by using a form-block (right) on a Hydroform.

New Metal-Shop Methods at Convair

By H. D. CROMARTIE, General Foreman
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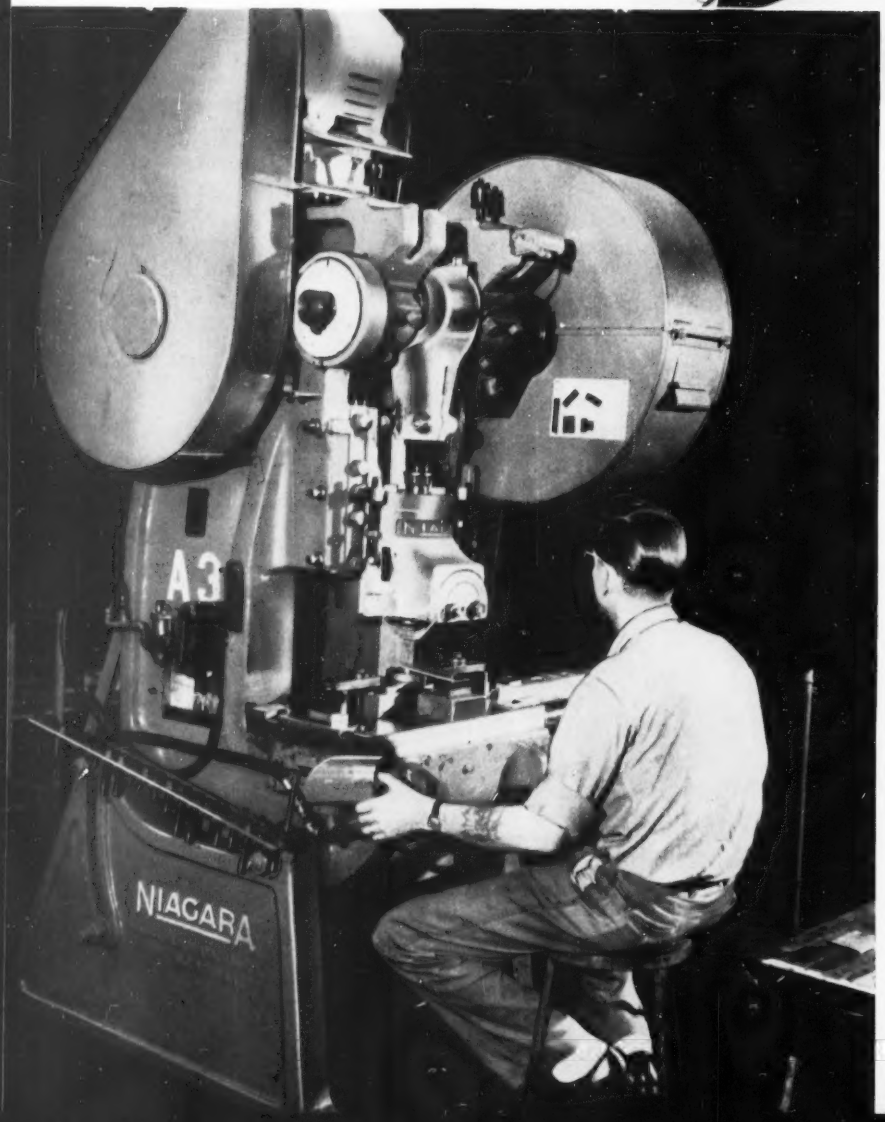
General Dynamics Corporation
San Diego, Calif.

Convair F-102 Supersonic Interceptor



IMPROVED production methods put into operation in Convair sheet-metal shops in San Diego, Calif., will save the company thousands of dollars annually. They are speeding up the fabrication of parts for supersonic delta-wing interceptors, Flying Classrooms, Samaritans, Convair Liner transports, and Tradewind turboprop seaplane transports.

One of the important developments in the sheet-metal shop is the application of impact forming for nearly all small work. Hand forming has been practically eliminated except for unusual shapes. The machine employed for impact forming is an adapted Cecostamp on which a heavy steel anvil is bolted on the press bolster plate, as shown in Fig. 1. The upper die member attached to the ram is made with a hole concentric to the anvil and 1 inch over size. This hole is filled with four layers of 80-Shore rubber 1 inch thick. Work is placed on a form-block laid on the anvil, as seen in Fig. 2. The form-block is usually provided with two or three vertically projecting pins to properly position the sheet-metal blank on the block. A large sheet of 90-Shore rubber, either 1/2 or 1 inch thick, is placed over the work before the descent of the upper die member. This die member is provided with a hole somewhat larger in diameter than the anvil.

The operator is important in producing a finished work-piece. He can usually obtain desired results with one strike of the upper die. Pressure built up in the rubber as it flows around the sheet-metal blank and the forming block has been estimated as high as 20,000 pounds per square inch.

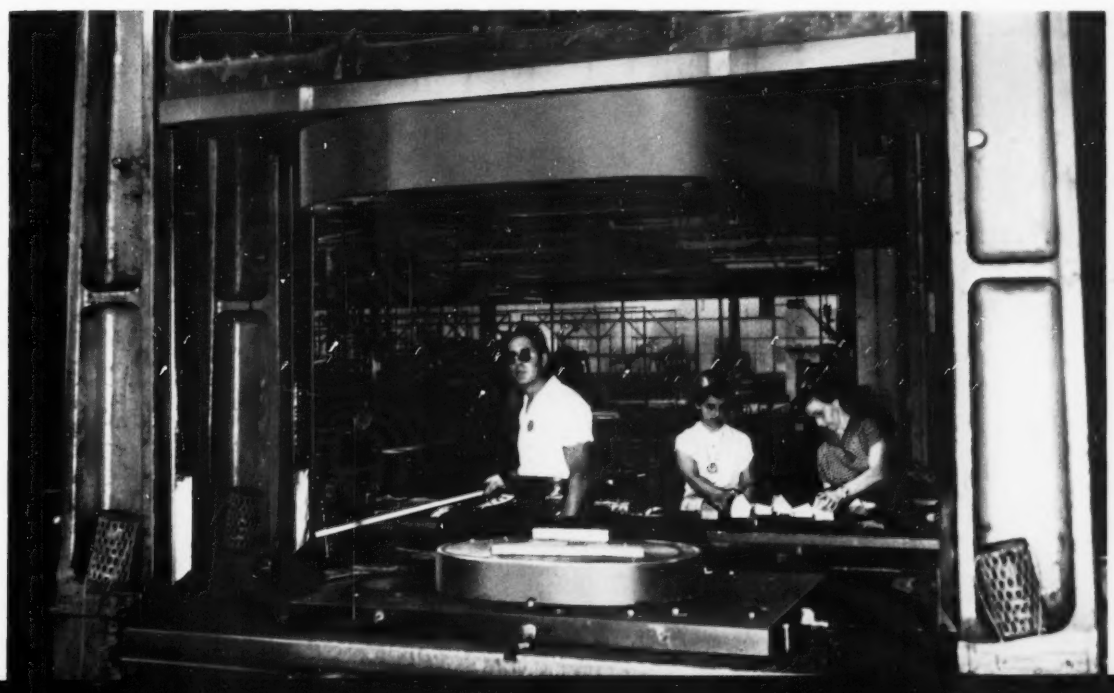
When heavy sheet metal is used and extreme bends and curves must be formed, some wrinkles cannot be avoided. In order to eliminate a problem resulting from such a condition, the forming department consulted with the tool engineering department and discovered that in some cases wrinkles could be formed into decorative flutes. These could be designed into the work-piece in locations where they do not affect the strength or interfere when performing the final assembly operations.

Holes are now being punched in light-gage metals by the use of steel punches and simple dies made of Kirksite, instead of employing the conventional method of using a steel punch and steel die, sharpened and matched, to operate closely as a pair. Light-gage metals have a tendency to burr if there is the slightest misalignment between the steel punch or steel die, or if they become dull. Sharpening of these tools is a time-consuming operation.

In making the Kirksite die, a solid block of this material is locked in position below the ram, then the hole is cut in the die to the desired size and shape by merely forcing the punch through. The slug of metal falls through the hole in the press bolster. Various Kirksite piercing dies produced by this method are seen on this press in Fig. 3.

With this type of tool there is no possibility of the die and the punch not being accurately

Fig. 1. Impact forming under a pneumatic drop-hammer has been adopted for production of practically all small-sized sheet-metal parts.



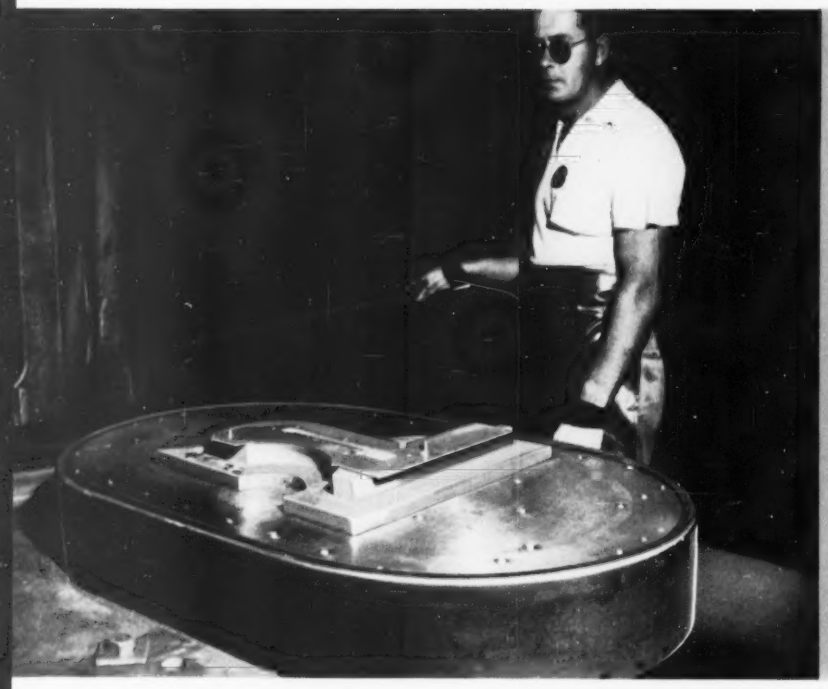


Fig. 2. In impact forming, the sheet-metal blank is placed over a form-block that is provided with small vertical pins to insure accurate location of the work-pieces.

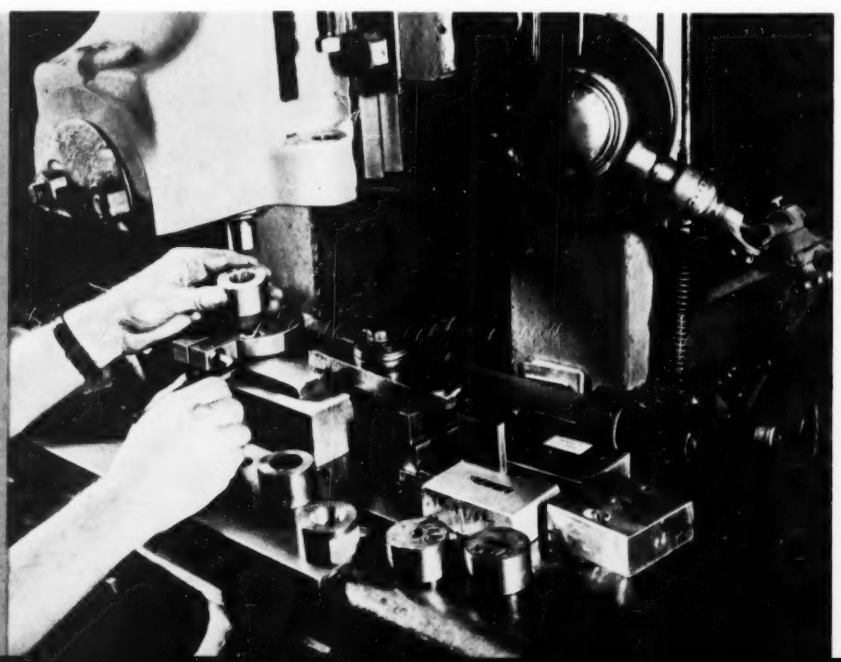
aligned and matched. They produce holes in work-pieces without burrs, and punches no longer become chipped due to misalignment. Another outstanding advantage is that the steel punches last five times longer than if they are used in combination with matched steel dies. Among the materials that respond well to this punching method are 0.032-inch thick plastics, 0.020-inch thick magnesium sheets, and 0.020-inch thick 24S-O aluminum sheets.

Some dies have been made by the same process from 24S-T aluminum instead of Kirksite. In tests conducted with aluminum dies, as many as 2500 operations have been recorded before even slight burring occurred on the work.

Ducts for aircraft systems are made by Convair with circumferential stiffening beads. Until recently, the beads were formed on a pinch type rolling machine. This operation resulted in considerable scrap because of improper forming of the beads and deformation of the duct in the operation.

The machine shown in Fig. 4 is now turning out the beaded ducts with no scrap and in a fraction of the time formerly necessary for the operation. The machine consists primarily of a die

Fig. 3. Kirksite dies, in which the hole is produced by the steel punch used in piercing operations, have replaced steel dies matched with the punches.



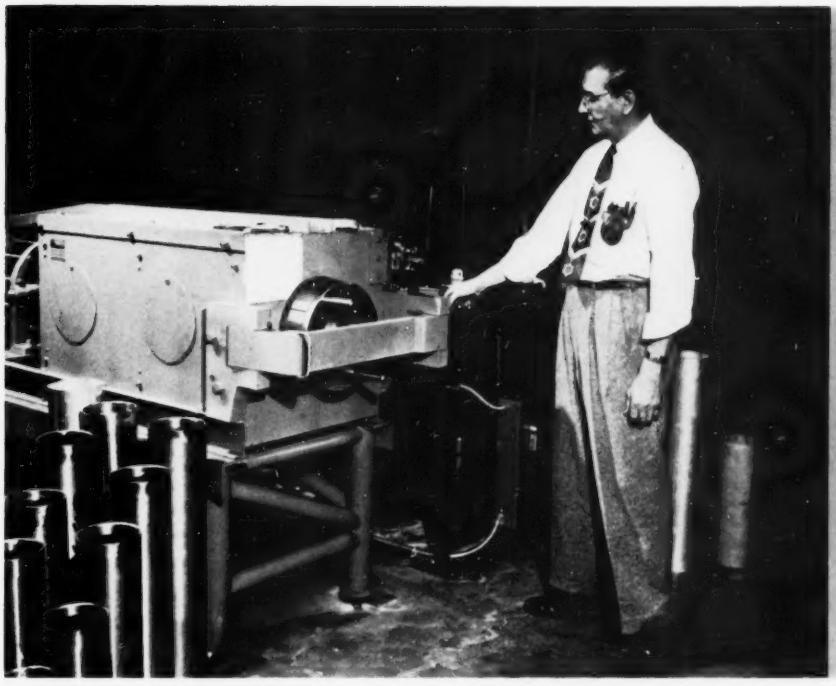


Fig. 4. Hydraulic machine for forming beads in sheet-metal ducts, the cylinders at the left being spacers that are inserted in the die for locating ducts of various lengths.

cavity and a rubber mandrel that is inflated under hydraulic pressure. As seen in Fig. 5, the die is made in three segments cast from Kirksite. These segments can be opened and closed by pneumatic pressure for inserting and removing the ducts. Opening and closing are achieved by pushing or retracting the die members, respectively, into three matched rings through the action of a 10-inch air cylinder and ram. When closed, the die is cylindrical in shape.

The rubber mandrel bag is attached to a solid steel bar that is fixed rigidly in the center of the die, being mounted as a cantilever from the back end. When the die is closed, the mandrel moves forward with it. During the operation, a cover plate and hinged clamp completely close the hydraulic equipment, as seen in Fig. 4. Hydraulic pressure of 3500 pounds per square inch is forced into the rubber bag to draw the beads to their full depth. There is a safety valve on the line which feeds air to the cylinder that opens and closes the die. This valve prevents the die from opening at the end of an operation before the oil pressure in the rubber mandrel has been reduced to 5 pounds per square inch.

Ducts formed on this machine match the beads

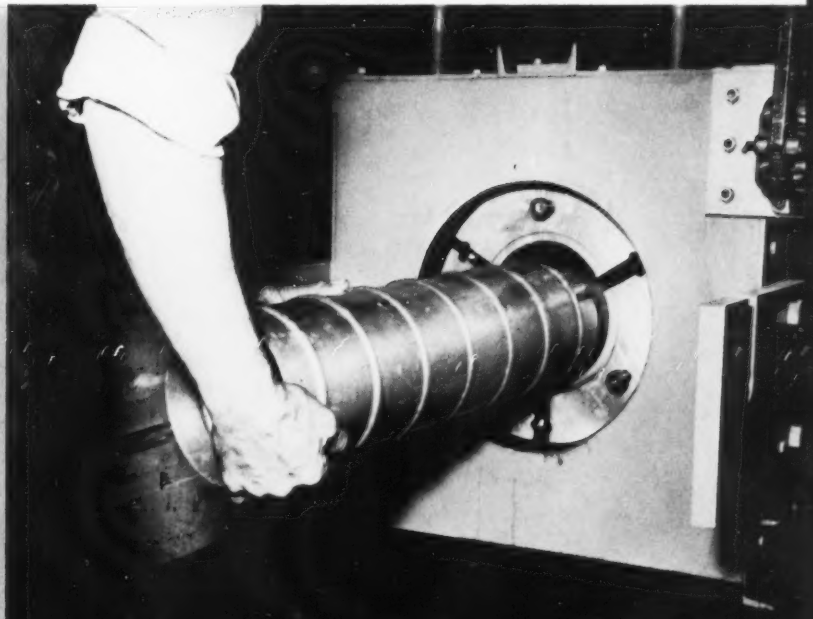


Fig. 5. The bead-forming machine consists primarily of a three-segment Kirksite die and a rubber mandrel bag that is extended by hydraulic pressure.

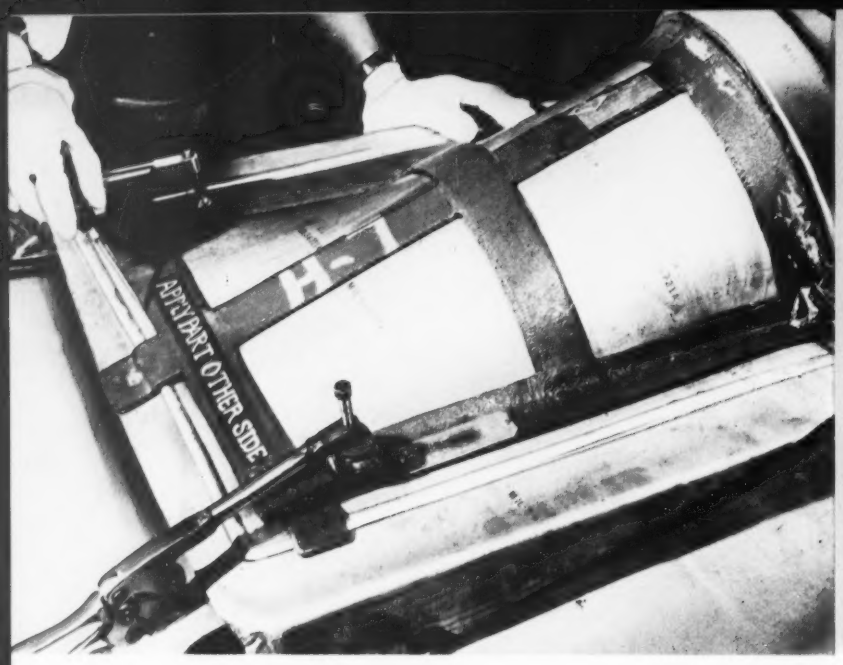


Fig. 6. Template constructed of ten sheets of fiber glass bonded together by resin; templates of this type are rapidly replacing steel tooling.

of the die cavity accurately. The ducts are left round and much stiffer than when the beads were formed by rolls and there is no warpage of the ducts. The beads are spaced about 4 inches apart. The ducts are 6 inches in diameter and are made from 0.025-inch thick 21S-W aluminum. They have a seam-welded lap joint. The depth of the beads is 0.156 inch and the beads are made with 1/4-inch corner radii.

Fiber-glass templates, such as shown in Fig. 6, and drill shells or jigs of the type illustrated in Fig. 7 are rapidly replacing steel tooling in the Convair plants. These templates and shells save substantial sums in fabrication costs and man-hours. They are light in weight, making them easy to handle and store. Flat templates can be rolled up for storage.

Templates and drill shells made from fiber glass do not damage the surfaces of aluminum aircraft components, a contingency that must be carefully guarded against. Templates and drill shells of fiber glass have been made in sizes ranging from a few inches square to as much as 48 by 108 inches. The templates, assembled on plaster forms, consist of ten layers of glass cloth impregnated with resin. Drill shells are made in the same manner, with the steel drill bushings properly located. These drill shells retain their shape better than steel, resulting in more accurate aircraft parts.

Currently, about 25 per cent of the templates and drill shells are made of fiber glass. On new model aircraft now going into production, Convair expects to increase the use to approximately 95 per cent.

A simple method of applying lubricant to sheet

Fig. 7. Fiber-glass drill shell employed for a wing leading-edge section, which has replaced a heavier steel shell.

Fig. 8. Lubricant is now applied uniformly to metal sheets prior to forming operations through the use of simple paint rollers manipulated by hand.

stock prior to forming operations has also resulted in production advantages. The method involves the use of a standard paint roller 8 inches wide, as shown in Fig. 8. Prior to the adoption of a roller for this work, a brush was used. The roller method is about ten times faster than the brush method. Parts can be lubricated immediately before forming operations so that the stock does not accumulate dust, chips, or foreign particles. Lubricant is spread evenly on all surfaces by this method, and the part may be formed before the lubricant drains off or collects unevenly.

Standard hydraulic presses are customarily provided with manual emergency controls for stopping the travel of the head when a sliding work-table is only partially below the head. If the operator is not constantly alert, the press head may shear the work-table, causing damage to both the machine and the work-table.

In order to prevent accidents of this type, a micro switch has been installed on each side of the head on the hydraulic press shown in Fig. 9. The switches are located on the head directly over the press table. Both micro switches have a 90-degree feeler which extends downward from the head. This finger will actuate the corresponding micro switch if one of the sliding work-tables is not in position for the downward movement of the press head. The switch will then cause reversal of the press head travel, preventing damage. It is estimated that this simple foolproof arrangement is saving the company about $1000 annually in the San Diego plants. However, the exact amount of the savings is difficult to determine, as even minor damage can be very costly.

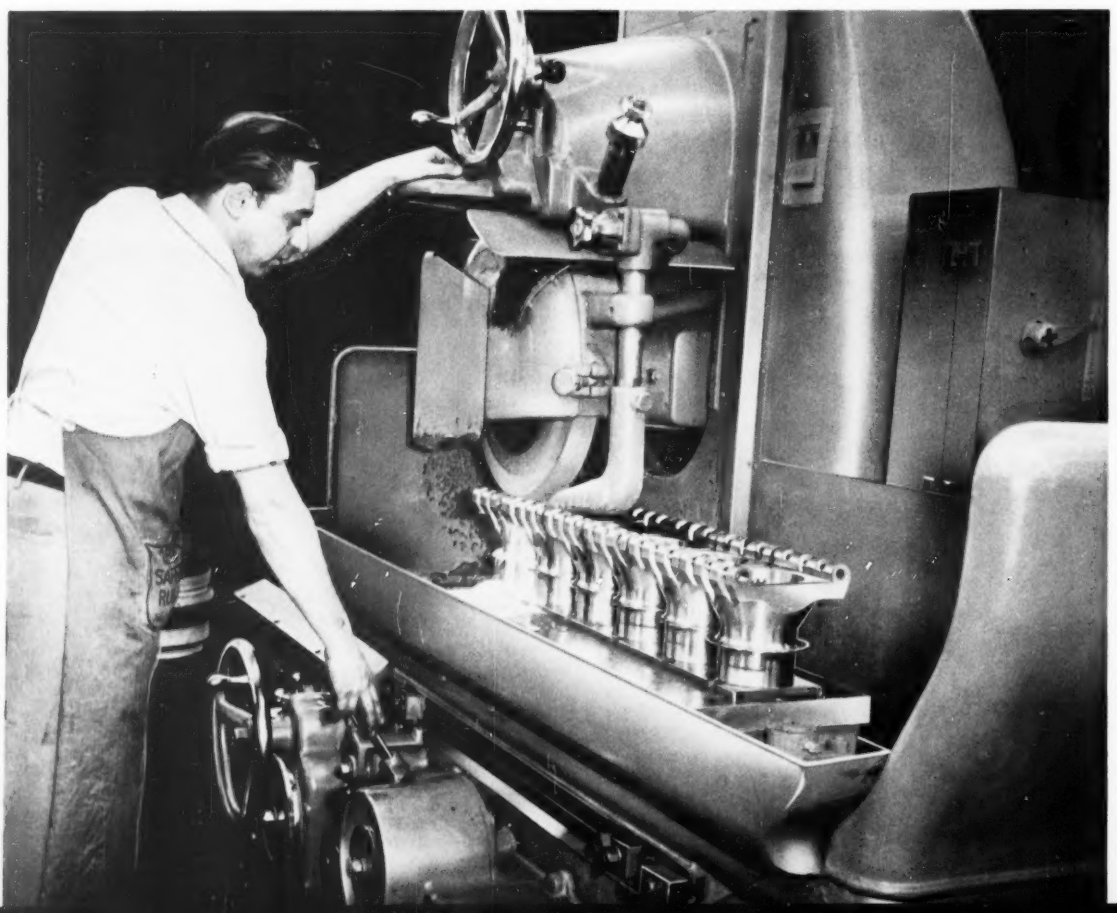
Fig. 9. Micro switches having feelers guard against the descent of head before the work-tables have been properly positioned.

Standard Machine Tools Helicopter Components

PRODUCTION of rotor heads and transmissions for Sikorsky S-55 helicopters is a major activity in the new plant of the Fenn Mfg. Co., Newington, Conn. This modern facility was set up through the cooperation of the United States Air Force and through liaison with the Sikorsky purchasing and tool engineering departments. Unique fixtures, special gages, and special cutting tools enable the rotor heads and transmissions—two highly critical parts of the airplane—to be turned out with standard machine tools. The company does all machining, heat-treating, plating, and inspecting of the parts, delivering them to Sikorsky in kit boxes ready for assembly. Several of the very practical adaptations in the plant are considered in this article.

Grinding a step diameter in steel liners, which are shrunk fit in the rotor head aluminum hub plate, is shown in Fig. 1. With the part located over a plug on a simple right-angle fixture, a Heald planetary type internal grinding machine completes the liner of each arm successively. A second plug on the fixture provides a means of accurately indexing the three arms. Without this set-up, a gap grinder large enough to swing the hub plate would be necessary.

Other major components of the rotor head are



Produce

By HENRY A. ROCKWELL
Vice-President in Charge of Production
Penn Mfg. Co., New Hartford, Conn.

Sikorsky S-55 Helicopter

Still small both numerically and percentage-wise in the over-all picture of aircraft production, the helicopter is daily expanding its reputation by successful completion of new military and civilian missions. Performance of many of these "egg beaters" literally revolves around the rotor heads and transmissions coming from the plant of a metal-working equipment builder

molybdenum steel (S A E 4340) die forgings. To assist in obtaining the necessary quality of surface finish, the material is machined in a relatively hard state—34 to 38 Rockwell C scale. One of the forgings, a spindle, is shown in Fig. 2 being line-bored on a bridge type Ex-Cell-O machine. There are three such spindles in the rotor head assembly.

The work is cradled in the vee of a simple fixture keyed and doweled to the machine table, thus assuring squareness of the bores to the spindle center line. The two bore diameters, of different size, are simultaneously roughed and finished by single-point cutters. Hole alignment is assured by a bushed vertical plate integral with the fixture, serving to pilot the boring-bar.

In Fig. 3 is shown an earlier operation on the spindles, that of straddle-milling the four faces. The view illustrates how a rigid cutter and work set-up allows the full power of a modern machine tool to be utilized. The Kearney & Trecker No. 4 horizontal knee type milling machine climb-cuts the faces at a surface speed of 275 feet per minute and a feed of 6 inches per minute. Massive mills, containing tungsten-carbide inserts, in combination have a flywheel effect that keeps performance vibration-free. Other factors—the positioning of the mills close to the column, the use of both intermediate and outboard arbor supports, and the thrust props of the fixture directly beneath the work surfaces—also contribute to the smoothness and accuracy of the cut.

The arm contours of rotor head hinges are rough-machined by string planing, seen in Fig. 4. There are three hinges for each head, twenty-four hinges being handled simultaneously. In the work set-up on the Gray 12-foot open-side planer, a long bar serves as a mandrel, running through the previously completed inside diameters. During the stroking, the operator coordinates manual cross-rail and tool-slide feeds, adjusting the cutter to the outline of a target in line with the work string. The cutter, made of cobalt high-speed steel, operates at 75 feet per minute.

A set-up involving a pilot type fixture, Fig. 5, makes possible the accurate taper-reaming of two rows of holes in the sleeves of the head. The fixture, set up on the table of a Universal 3-inch horizontal boring mill, has integral projecting members at each end, serving as pilots. Cylindrical sections on the special Gammons-Hoaglund reamers used are accommodated in these members. Rough-, semi finish-, and finish-reaming are performed on the machine. The reamers are held in a Ziegler floating holder. Taper depth is critical, being controlled by the abutment of adjustable ring nuts on the reamer shanks against the face of the front projecting members. In a subsequent manual operation, a fourth reamer sizes the taper to the required degree of accuracy.

Another operation on the sleeves can be seen in the opening illustration. Here, a flat surface tangent to a radius is surface-ground on a 16- by 48-inch Mattison machine. A gang of six sleeves is handled simultaneously. A simple, multiple fixture held to a magnetic chuck grips the work internally during the operation.

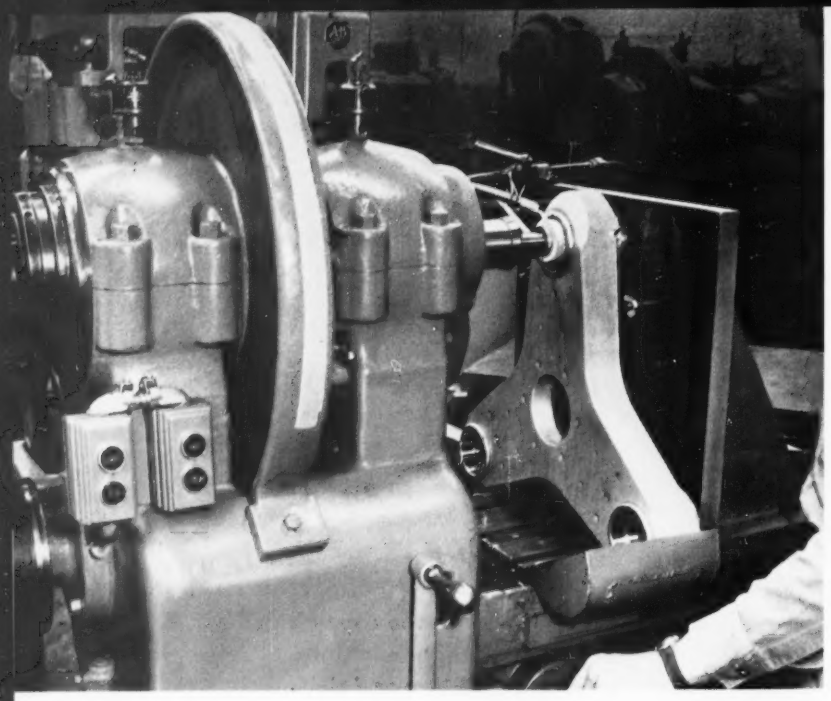


Fig. 1. Too bulky to be swung on available equipment, the hub plate is conveniently handled on a planetary grinder.

The production of the transmission for the helicopter involves, as might be expected, a variety of precision gear-cutting, grinding, and heat-treating steps. Shown in Fig. 6, for example, is the finish-grinding of an interrupted-tooth internal ring gear. An exacting operation, it is necessary to avoid all lead error and grinding cracks in the work. The Geargrind machine used is equipped with a Hoglund Magni-Form diamond wheel dresser. This is a hydraulically actuated device controlled from a template of the involute form through inclined planes. There are two diamonds, each one dressing, in turn, an involute side, the adjoining round corner, and one-half the periphery of the wheel.

All spiral bevel gear components of transmissions are cut on Gleason roughers, hardened, and then finished on Gleason hypoid grinders. A close-up view of a grinding set-up is shown in Fig. 7. By grinding, the required tooth bearing patterns and close backlash tolerances are more readily obtained. The grinding machine operates on an automatic cycle, with the number of passes governed by the amount of stock to be removed.

Good fixture design simplifies the hole-boring of the rear cover for the main transmission. There are seven holes bored in this part, shown in Fig. 8 clamped to a knee type fixture in a Dixi jig mill. To position each hole on the machine center line, two dowel pins in the cover are accommodated in one of seven pairs of corresponding locating bushings in the fixture, and the part is then clamped.

Dowel-pin holes and counterbored shaft holes

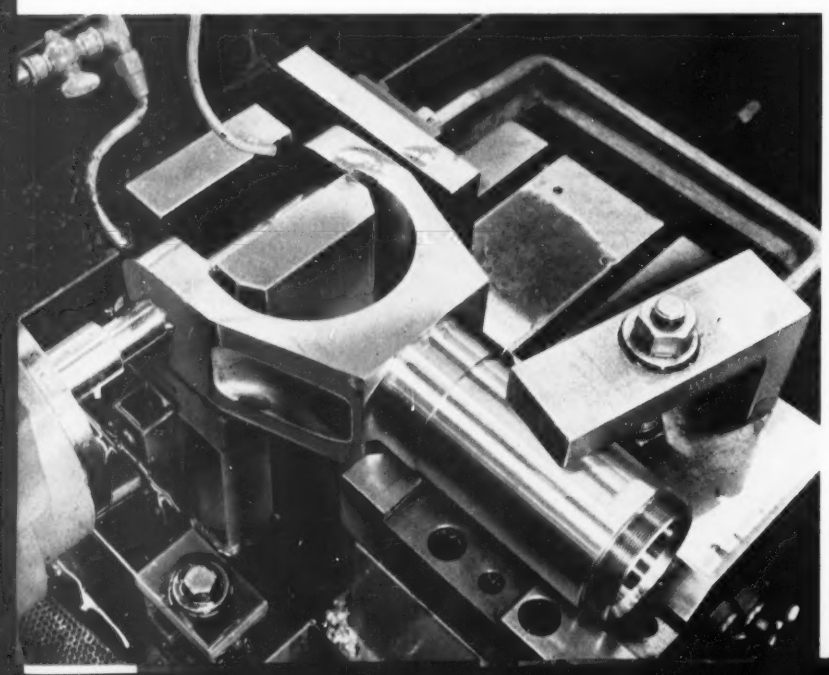


Fig. 2. Hole alignment of spindle cross-holes is assured by a boring-bar piloting section integral with the work-fixture.

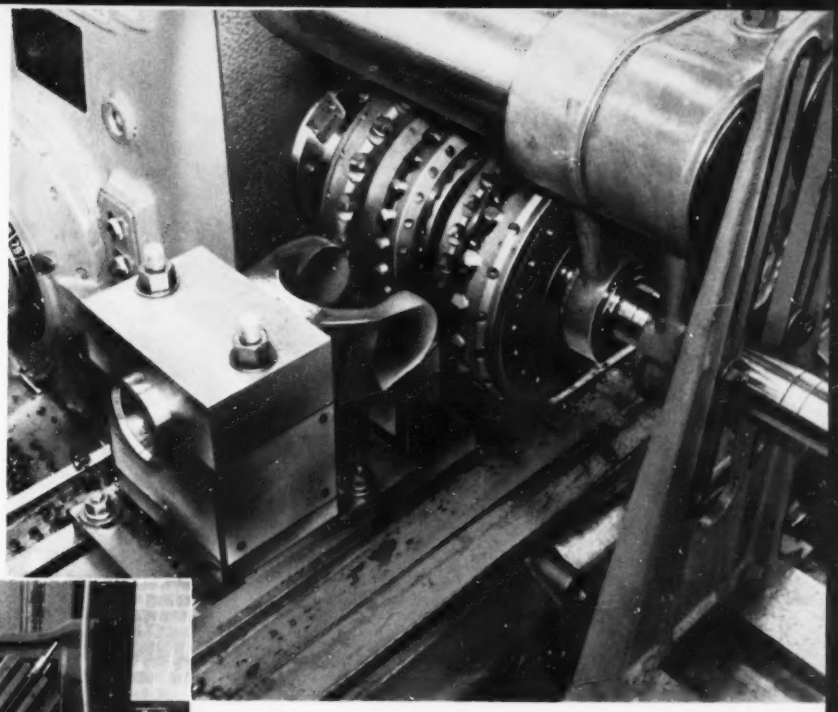


Fig. 3. (Right) All the tenets of good milling practice are observed in this set-up of the work and cutters.

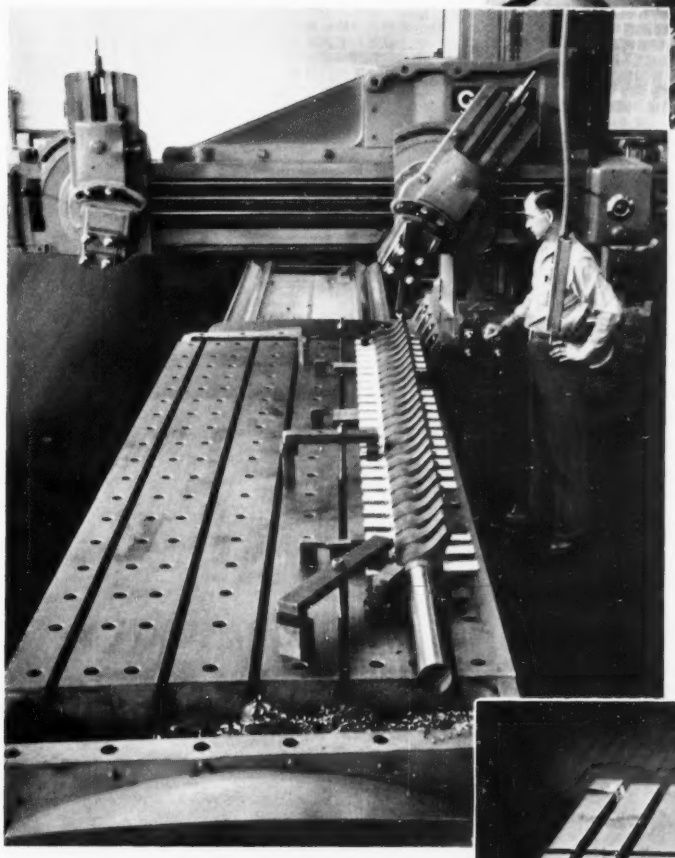


Fig. 4. (Left) In the string planing of the arms of rotor head hinges, the contours are developed from a target.

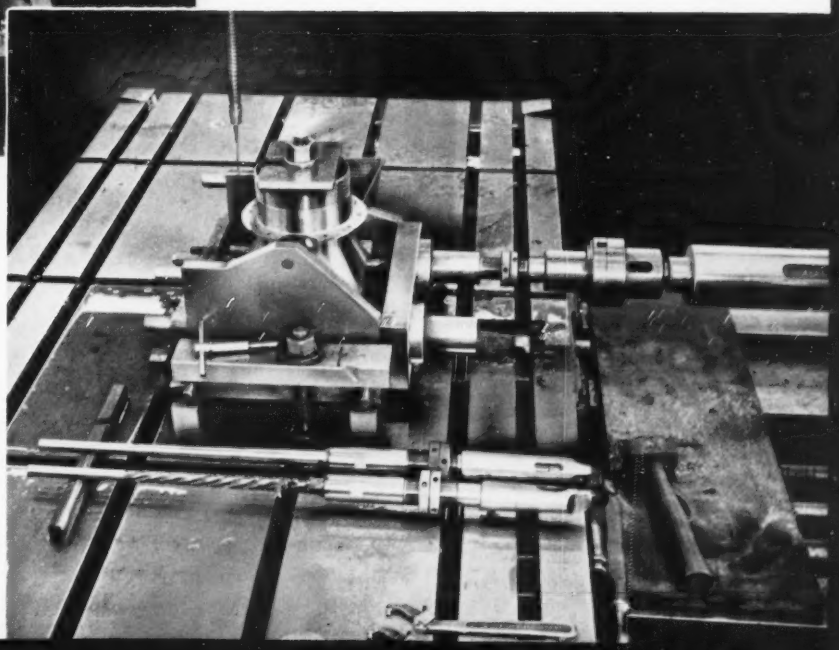


Fig. 5. Cylindrical sections on the tapered reamers permit them to be piloted in work-fixture. A floating holder compensates for any slight misalignment of the spindle.

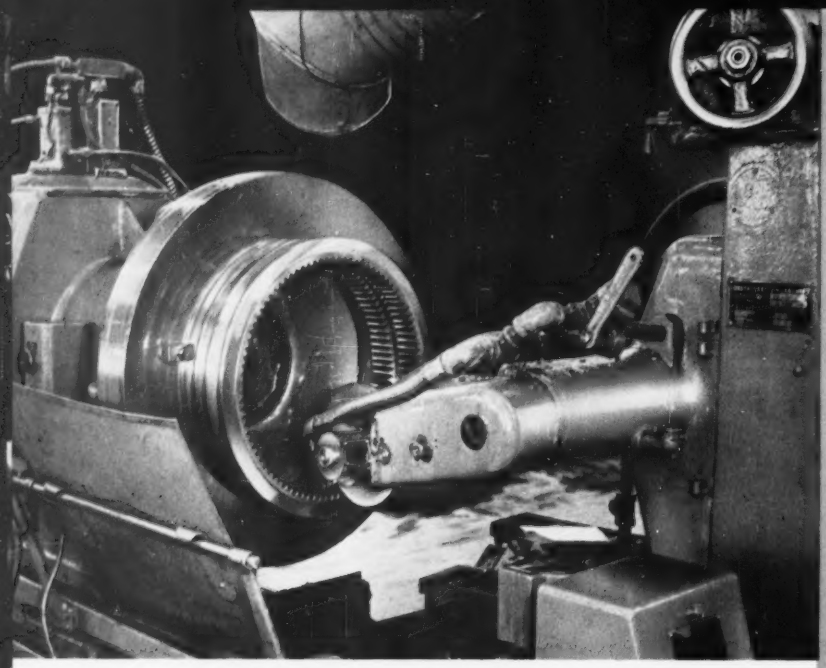


Fig. 6. The contour wheel dresser mounted on the machine permits close control of the involute form of the grinding wheel.

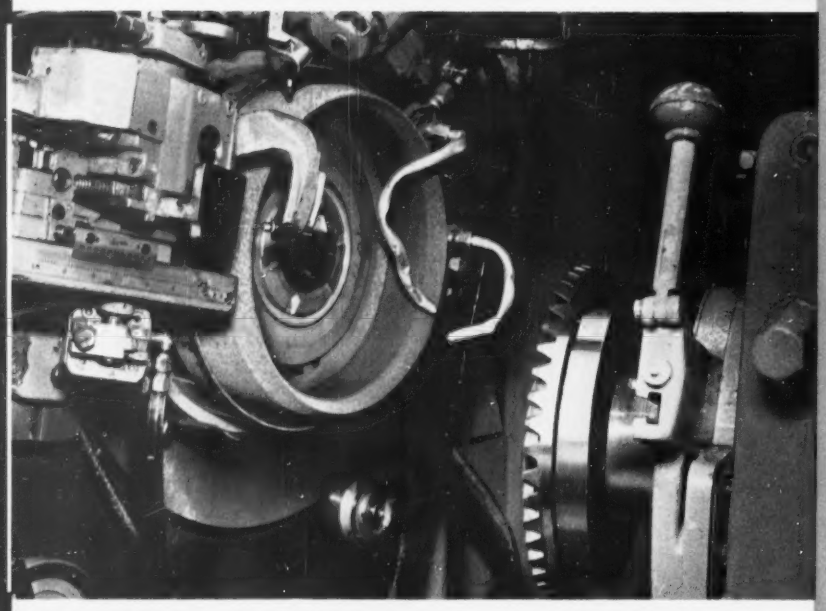


Fig. 7. Grinding a spiral bevel gear for the helicopter transmission. The machine completes its cycle automatically.

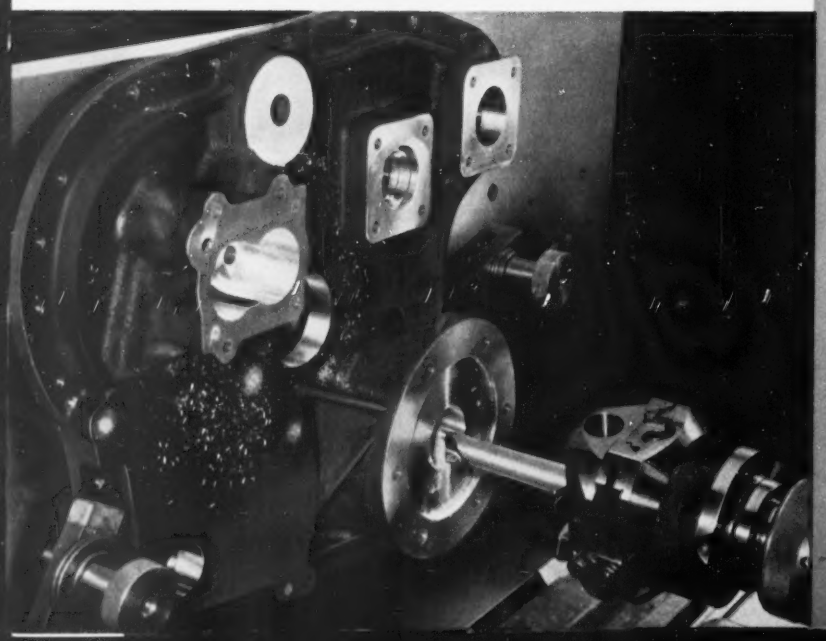


Fig. 8. For each of the seven holes to be bored, the dowel-pins in the part engage a different set of bushings in the fixture.

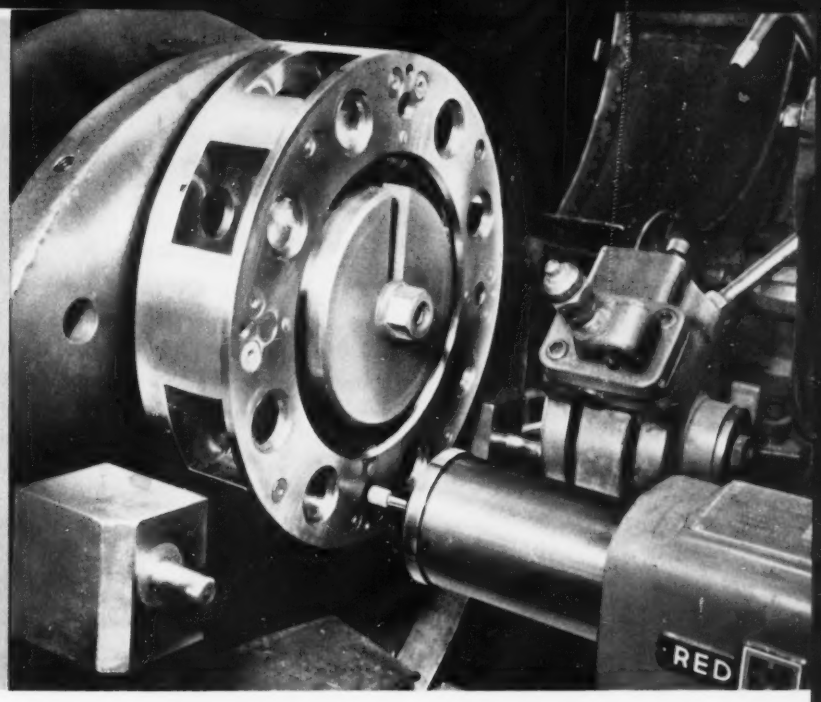


Fig. 9. The pinion cage assembly of the transmission is bolted to a counterbalanced fixture on the gap-base grinding machine.

in the pinion cage assembly of the transmission are finished on a Heald internal gap-base grinding machine, Fig. 9. The fixture incorporates an accurate work-indexing feature so that close center-distance tolerances are readily held.

As is the case with most aircraft parts production, emphasis is placed on surface finish. All surfaces, even drilled holes, must have a finish of 100 micro-inches r.m.s. or better, and, in some instances, as fine as 4 micro-inches r.m.s. Frequently, it is more economical to grind to size from the rough surface, rather than to finish-turn or bore.

Both Sikorsky and the United States Air Force have resident inspectors at Fenn. All steel rotor head and transmission parts are subjected to a 100 per cent Magnaflux inspection. In Fig. 10 is shown one of the three units employed, the operator here checking a hardened and ground transmission gear for cracks and non-metallic inclusions. Aluminum and magnesium parts are given a Zyglo fluorescent penetrant inspection.

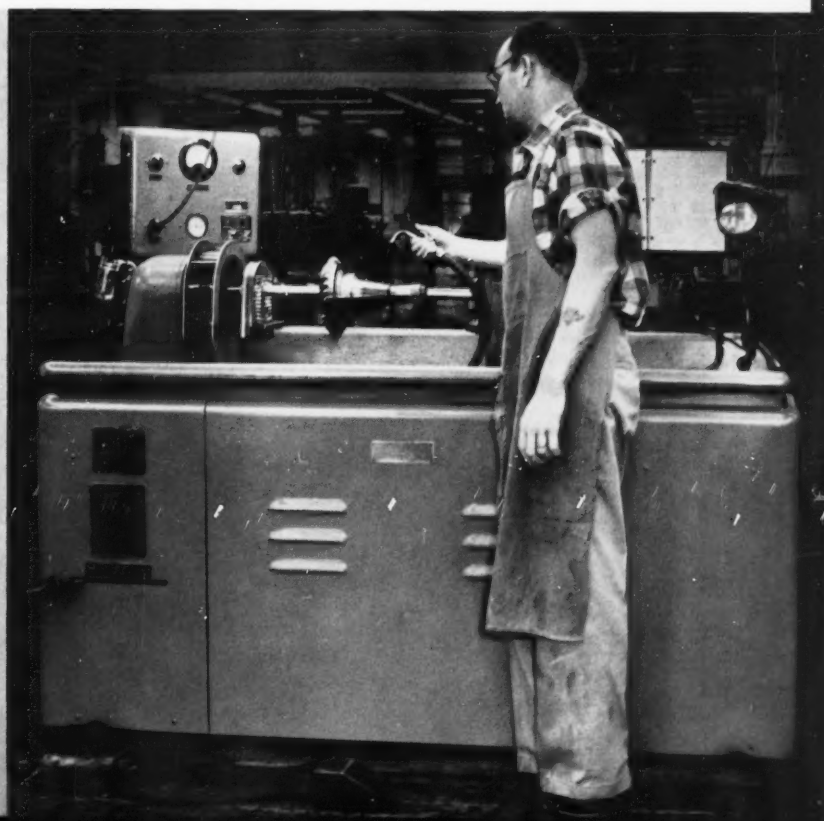


Fig. 10. A 100 per cent Magnaflux inspection of all steel rotor head and transmission parts follows shop operations.

Jet-Engine Overhaul

By J. C. CUNNINGHAM
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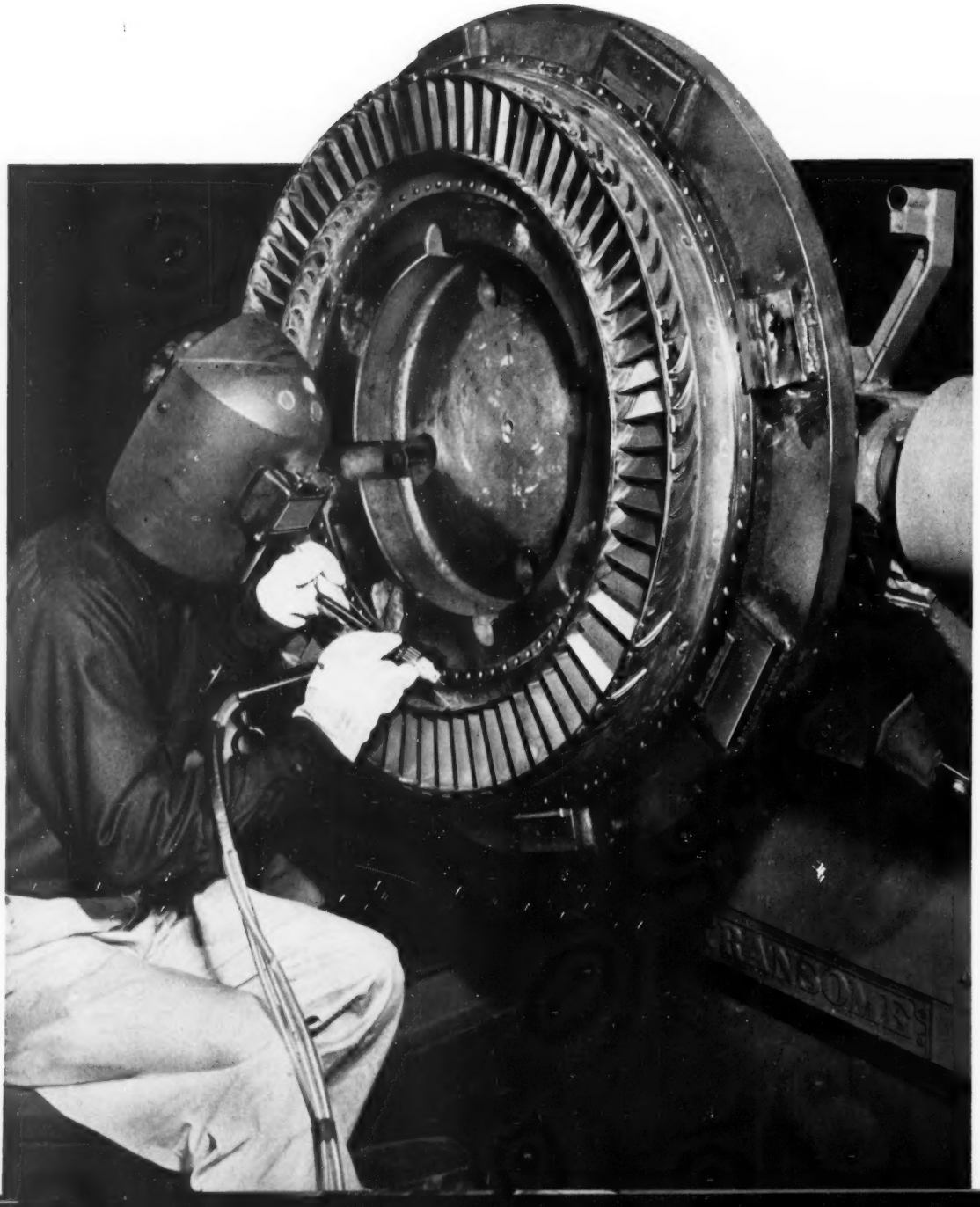
Allison Division, General Motors Corporation
Indianapolis, Ind.



Reduces Defense Costs

WHEN turbo-jet engines were first introduced as power plants for aircraft near the end of World War II, it was thought that their operational life would be exceedingly short. It was also felt that turbo-jet engine maintenance would be very costly due to anticipated frequent overhauls and the need for numerous parts replacements.

In the few years since their inception, however, the efficiency of turbo-jet engines has constantly improved, and their cost has been considerably reduced. Improved designs, better materials, and more precise manufacturing and inspection methods have all contributed to lengthening the operational life of the engines. Also, experience under all kinds of flying conditions and in actual combat has permitted a continual increase in the number of hours of operation between overhauls.

Dependent upon the conditions revealed at disassembly, modern turbo-jet engines can be overhauled many times, thus increasing their life indefinitely. In addition, improved overhaul techniques have made it possible to reduce the defense budget requirements for such engines. Special tools and methods that have been developed by the Allison Division of General Motors Corporation to facilitate the overhaul of J35 axial-flow, turbo-jet aircraft engines will be described in this article.

A major problem encountered in overhauling this type engine was the disassembly of the eleven-stage, axial-flow compressor rotor. The rotor assembly consists of alternate discs (containing compressor rotor blades dovetailed to their peripheries) and spacer rings that are held together with flattened wire calking strips and drive pins that have been staked.

A special fixture developed to pull the eleventh stage disc from the compressor rotor is shown in Fig. 1. In this operation, the hub of the eleventh stage disc is packed with dry ice and alcohol, and allowed to set for about twenty minutes in order to shrink the compressor rotor shaft. The disc is expanded by heating with a gas (mixture of propane and oxygen) flame, the torch being moved from the outside of the disc toward the hub during heating. A surface pyrometer is employed to measure the surface temperature, and heating is discontinued when the temperature reaches approximately 700 degrees F.

After shrinking the shaft and expanding the compressor rotor disc, the separating device—consisting of a 50-ton hydraulic jack and puller bolts—is applied. The assembly is lifted by the bolts and pressure is applied to the shaft by the jack, thus pushing the shaft out of the compressor rotor disc.

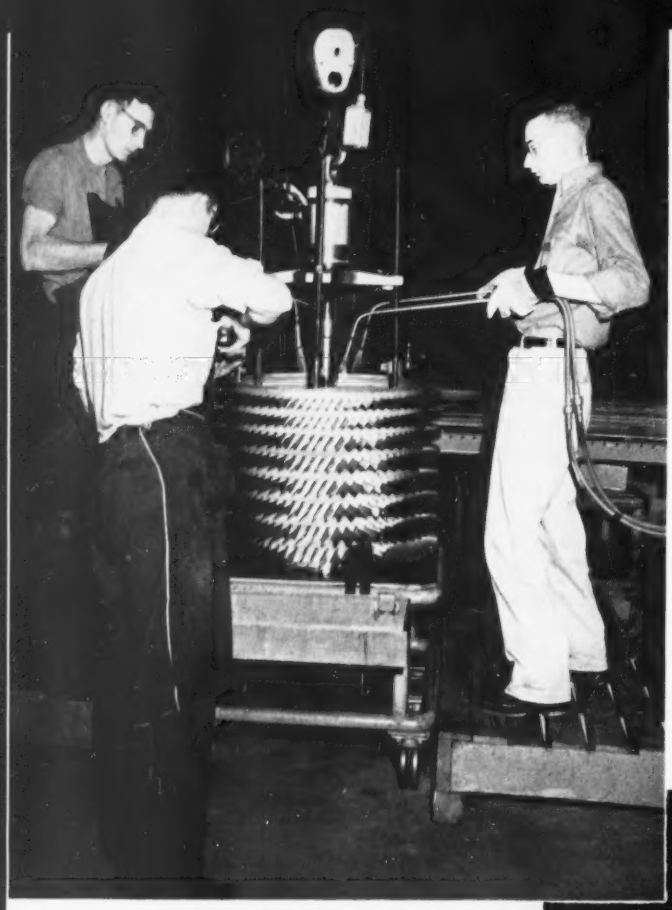
Spacer rings are removed from the other stage rotor discs by means of a multiple-jack disassembly fixture, Fig. 2, called the "octopus." In this device, a pressure ring is applied between the jacks and the web of the compressor rotor disc for more even distribution of the hydraulic jack pressures. The vise jaws are clamped on the spacer ring to be removed, and the pistons of the 3-ton jacks push on the high points of the pressure ring, thus separating the ring and disc.

To minimize galling and possible scrapping of the compressor rotor shafts (which sometimes occurs when using the fixtures previously described), the new disassembly fixture seen in Fig. 3 is being developed. This fixture was designed to permit separation of all the spacers from the various stage discs, immediately after the eleventh stage disc has been removed from the compressor rotor shaft. The two vertical guide posts are designed to keep the compressor rotor in alignment during disassembly.

The compressor rotor assembly is loaded in the fixture by means of a slide table, with the rotor shaft projecting into a hole in the base of the fixture. Disassembly of the eleventh stage disc from the compressor rotor shaft is similar to the procedure followed on the fixture previously described, with the hub being packed with dry ice and the disc heated by gas flame. The main difference with the new fixture is that the center hub of a spider member of the fixture is screwed onto the hub of the eleventh stage disc. Pressure is applied to the disc hub by four puller bolts. The disassembled disc is then placed on a swinging table and removed from the fixture.

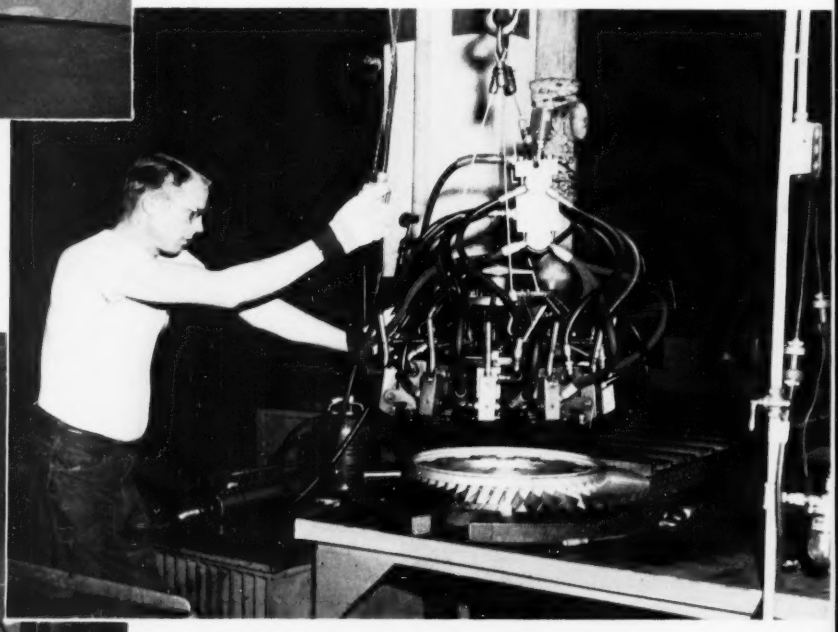
To remove the other stage discs from the spacer rings, each ring is successively clamped by a vise arrangement. It consists of six legs, locked and pinned at the correct height, each having a 7-ton jack. A 50-ton jack is activated to exert pressure against the compressor rotor shaft. This pressure pushes the disc free of the spacer ring.

After teardown of the compressor rotor assembly, the bladed compressor discs are cleaned of dirt, scale, rust, or other foreign matter, and



semi-polished by barrel finishing, as seen in Fig. 5. This operation is performed in a modified abrasive finishing barrel containing water, "lubricating" compound, and abrasive chips. The barrel remains stationary and is kept open, while the discs, clamped together on a shaft with spacers in between, are rotated at 50 R.P.M. Direction of rotation is reversed automatically every two minutes throughout the cycle.

Relatively fine abrasive chips are employed for barrel finishing. The aggregate is made up of 400 pounds of No. 5 chips and 200 pounds of No. 6 chips, the latter chips being of a size that will pass through screen openings 1/8 by 3/32 inch. Approximately 1 pound of a special acid compound is added to the aggregate to soften the water, clean the parts and chips, and deoxidize the work surfaces. Then water is added to serve as a carrier for the work, abrasive chips, and compound, and also to provide a cushioning action. Finished parts are rinsed with hot water



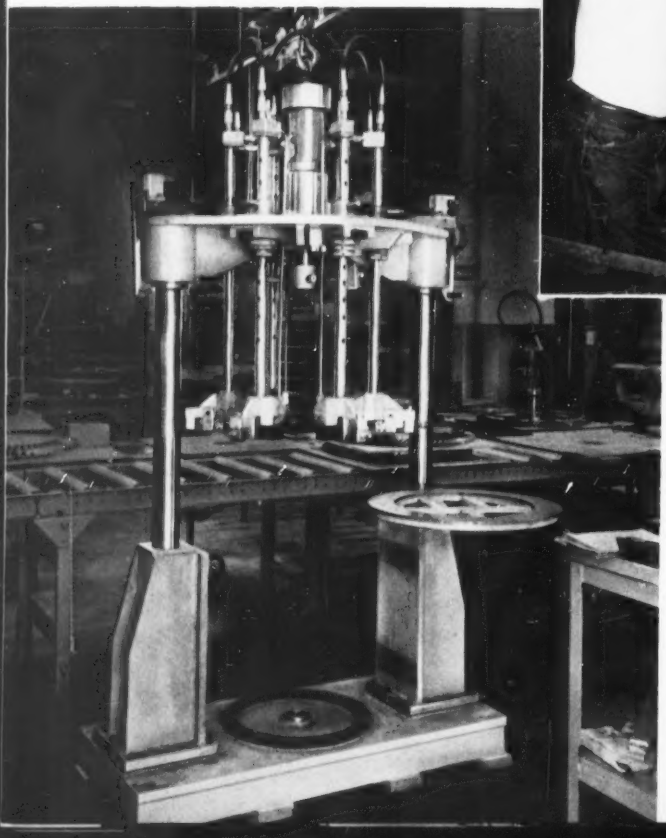


Fig. 1. (Top) Special fixture for hydraulically pulling eleventh stage disc from compressor rotor shaft on which it has been shrunk.

Fig. 2. (Center) Vise jaws are clamped on the spacer ring, and pistons of hydraulic jacks push the pressure ring against the rotor disc.

Fig. 3. (Left) Use of vertical guide posts on this rigid compressor rotor disassembly fixture insures alignment and prevents galling of shafts.

Fig. 4. Belts of 180 grit, aluminum-oxide abrasive are used to remove irregularities and blend surfaces of compressor blades.

and dried in air. Before cleaning more compressor discs, sludge is removed from the abrasive chips by rinsing with water.

After removing the compressor blades from the dovetailed slots in the peripheries of the rotor discs, the blades are reworked on abrasive-belt grinding machines, Fig. 4. Aluminum-oxide abrasive belts of 180 grain size are employed to remove burrs and nicks, and blend the surfaces of the blades. Reworked blades are heat-treated for stress relief, and polished by buffing.

Bottom surfaces of the roots on compressor rotor blades are refinished on surface grinding machines. Five blades are ground at a time, and the blades are located from their dovetailed roots and held by means of a magnetic chuck.

Split rings that hold the stator vanes in the bore of the compressor casing are removed from the casing by means of the special disassembly machine shown in Fig. 6. The compressor casing (half of the complete stator assembly) is slid into the fixture of the disassembly machine and manually clamped. The half-rings, in which the stator vanes are dovetailed, are pushed out of the casing by an air-operated, rotating lever that pivots about a member extending along the top of the fixture. An auxiliary air hammer is provided on the rotating lever to exert additional pressure when it is necessary to drive the ring out of the casing. Means are provided for manual indexing and shot-pin location to align the rotating lever with each successive vane ring.

Stator ring halves, after disassembly from the casings but with their vanes in place, are cleaned and polished by barrel finishing, in a manner similar to that described for the bladed compressor discs. The replacement stator vane tips are then ground to the required inside diameter on internal grinding machines. Two half-rings are mounted together, locating on their outer peripheries and against their faces, and the assembly is ground in one set-up.

Bolt flanges on the turbine nozzle diaphragms for the J35 turbo-jet engine are roll-formed back into the required shape and dimensions on a vertical turret lathe, as seen in Fig. 7. The special work-holding fixture on the rotary table

(Continued on page 226)

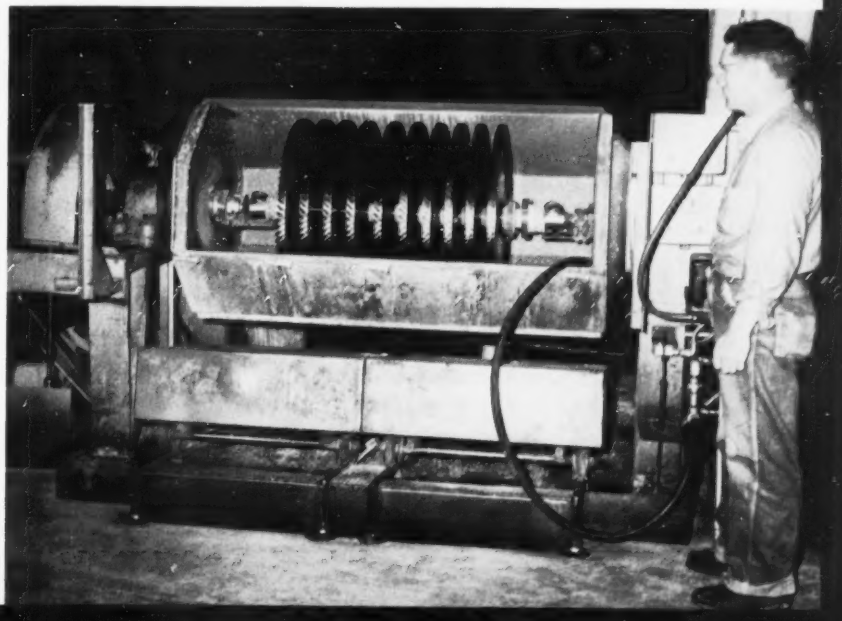


Fig. 5. Compressor discs are cleaned and semi-polished by barrel finishing. The discs are rotated in a water solution containing abrasive chips.

Precision Machining of Small Gas Turbines

By F. H. MINTURN
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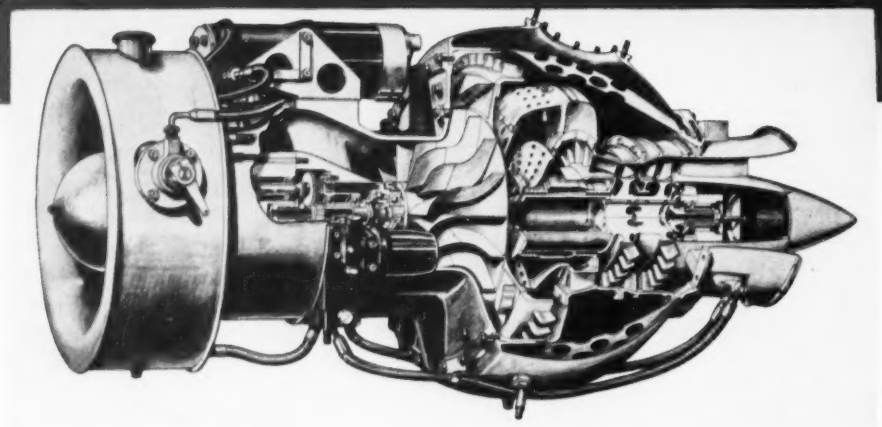


Cut-away view of compressed air generator containing two-stage gas turbine

Extremely close tolerances must be maintained in machining tough, heat- and corrosion-resistant materials employed for parts of compact, highly efficient gas turbines

A FAMILY of small gas-turbine engines being developed and manufactured by the Continental Aviation and Engineering Corporation, Detroit, Mich., is being adapted to varied applications, including jet training aircraft and helicopters. Currently in production is a trailer-mounted gas-turbine compressed air generator used as airport ground equipment to supply compressed air for starting turbo-jet engines, for generating electricity, and for air conditioning of aircraft.

This compressed air generator is a modification of the Continental-Palouste Model 140 gas turbine, a cut-away view of which is shown in the heading illustration. Basically, the unit is composed of a single-stage centrifugal compressor, an annular combustion chamber, and a two-stage turbine for driving the compressor. Useful air is bled from the unit after the air passes the diffuser vanes of the compressor, and prior to entering the burning region of the combustion chamber. Fuel is sprayed into the combustion chamber through relatively large holes in the whirling turbine shaft.

Total horsepower developed by the gas turbine to drive the compressor varies from 500 to 1000, depending on the temperature of the incoming air. Rated output of the compressor unit at the discharge end of a 30-foot duct is 150 air horsepower minimum, with the air at a pressure of 45 to 75 pounds per square inch absolute and a temperature of not less than 200 degrees F., nor

more than 650 degrees F. The gas-turbine compressor incorporates its own lubrication system, ignition system, fuel pressure pump, and electric starter. Over-all length of the engine is less than 48 inches, and its diameter is about 22 inches.

Heat- and corrosion-resistant materials of high strength are employed for many parts of the gas-turbine driven air compressor to permit operation at the high speeds (up to 35,000 R.P.M.) and temperatures necessary for optimum efficiency. Also, the compactness of design makes it necessary to maintain extremely close tolerances in machining the parts. Techniques and tooling employed at Continental for the limited production of gas-turbine components will be described in this article.

Buckets on the turbine rotor wheels are milled from the solid. The wheels, approximately 8 inches in diameter by 3 inches thick, are forged from Nimonic 80A high-temperature alloy containing about 75 per cent nickel, 20 per cent chromium, 2.5 per cent titanium, and 1 per cent aluminum. The first-stage turbine rotor wheel contains twenty-five buckets; and the second-stage wheel, thirty-three buckets.

The buckets on the forged wheels are rough-formed by trepanning cuts on a standard horizontal milling machine. Then, the intricate profiles of the airfoil surfaces and fillets at the roots of the buckets are rough- and finish-machined in three dimensions, two wheels at a time, on the special Cincinnati two-spindle profiling machine seen in Fig. 1. The work-pieces are held on indexing fixtures, with their axes horizontal, and special high-speed steel, four-lip cutters are mounted on the vertical spindles.

Paths of the cutters are automatically controlled by a hydraulically operated, 360-degree tracer mechanism. As the tracing stylus traverses the surface of a master bucket, the two turbine rotor wheels are automatically moved toward or away from the cutters. The cutters, rotating at

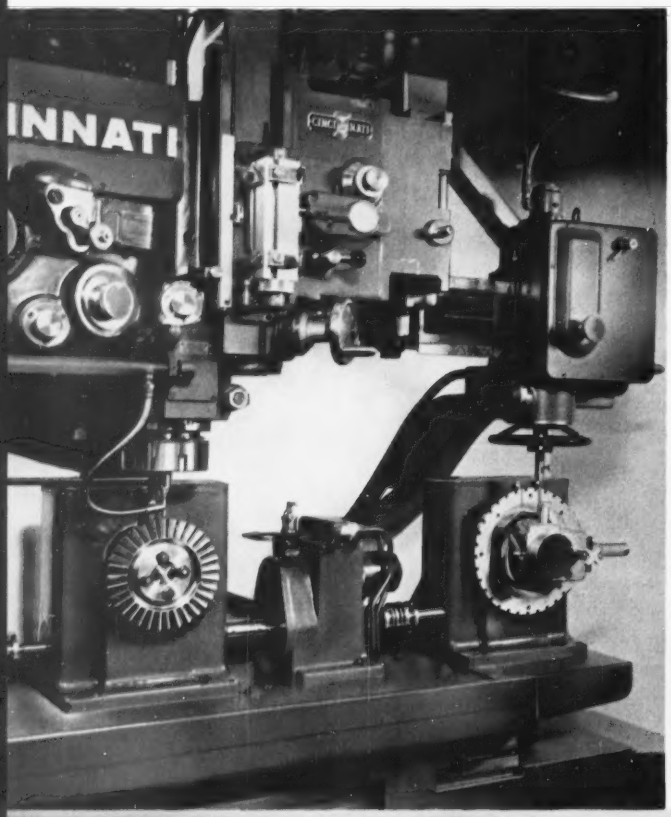


Fig. 1. Special two-spindle profiling machine equipped with hydraulically operated tracer mechanism for cutting buckets on turbine wheels

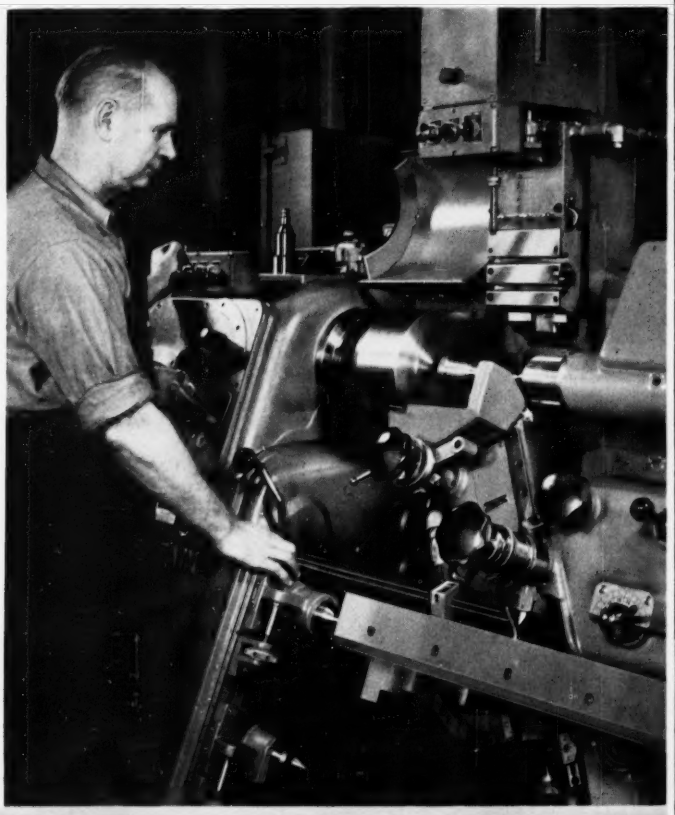


Fig. 2. Forged-steel front turbine shafts are faced to length and contour-turned on this hydraulic copying lathe with in-feed attachment.

a cutting speed of 65 feet per minute, are simultaneously power fed downward at the rate of 0.015 inch per revolution. From 1/32 to 1/16 inch of stock is removed in rough-forming the airfoil surfaces of the turbine buckets to a depth of approximately 1 inch, leaving 0.015 inch of stock for removal in finishing.

After completely finishing one bucket on each wheel, the wheels are indexed the required amount. The complete cycle is automatic except for indexing, loading, and unloading. To machine buckets on either the first- or second-stage turbine rotor wheels, it is only necessary to change the master, work-holding fixtures, and indexing adapters. About 12 pounds of material is machined from each forging, giving a finished weight of 7 pounds 6 ounces.

The front turbine shaft for the modified Continental-Palouste gas-turbine engine is made from a high-tensile strength, nickel-chromium steel forging, about 7 inches long and 3 inches in diameter. Facing and contour-turning of these forged shafts are performed on the New Britain-Fischer hydraulic copying lathe seen in Fig. 2. On this lathe, the copying mechanism is in a vertical plane, directly under the center line of the work-piece, and the hydraulic control system is enclosed in the carriage. The flat template, over which the tracing stylus is traversed to control the movements of the single-point, carbide-tipped contour-turning tool, is mounted on the front of the machine, near the bottom, to facilitate quick changes or adjustments.

A hydraulic in-feed attachment on the lathe permits facing the shaft to length while contour-turning. The same lathe, equipped with different templates, is also used to contour-turn other parts of the gas turbine (such as the rear turbine shaft), and contour-bore the intermediate shaft.

Compressor housings for the gas turbines are made from magnesium-alloy castings. Internal rotor and inducer surfaces in the housings are contour-bored, the joint surfaces are faced, and

the rabbeted diameters are machined on a Monarch tracer-controlled engine lathe, Fig. 3. The castings are held in a special fixture equipped with an expanding mandrel. Rough-machining, in which approximately 3/16 inch of stock is removed from the various surfaces, is performed before assembly of the front main-bearing liner. Finishing is done with the liner in place, and an additional 1/16 inch of stock is removed.

On this lathe, the contouring slide is controlled by a proportional control type of tracing device that utilizes the principle of an air-gaging circuit to actuate a four-way hydraulic valve. Air flow in the circuit is controlled by a stylus-operated valve in the tracing head, which is traversed past the template.

Internal vanes in the forged aluminum-alloy axial diffusers are contour-milled on a Turchan Hydro-Router, Fig. 4. Forged rings are rough-turned and faced, and then cut into three diffuser segments. This milling and routing machine is operated through hydraulic tracer servo-control —the cutting tool generating the vane profiles in the diffuser segment as the tracing stylus is moved over the master. The diffuser segment is held on a rocking fixture that positions the vane to be machined under the vertical milling cutter. Twenty-six vanes are provided on the inside of each segment. A Hartford Super-Spacer is used to index the work-piece. Feed rates are infinitely adjustable from 0 to 65 inches per minute.

In assembling the hot end of the engine, five parts—the two turbine rotor wheels, the turbine balancing disc, the rear turbine shaft, and the intermediate turbine shaft—are secured together by means of four bolts, each having a bearing surface 4 1/2 inches long. To insure optimum performance at high operational speeds and temperatures, the four bolt holes in each of the five parts must be held to size (0.3940 to 0.3946 inch) within only 0.0006 inch total tolerance. Also, the bolt holes must be located within 0.0005 inch of true position radially, and square with the faces of the parts within 0.0001 inch.

These stringent production requirements have been successfully met by precision grinding the bolt holes on the Heald single-spindle, chucking type, plain internal grinder seen in Fig. 5. All four holes in each part are ground in one set-up by indexing the work-piece, and all five parts are ground on the same machine by changing adapters on the special rotating, indexing fixture. Although the four holes in each part are on a bolt circle only 2 3/4 inches in diameter, the

Fig. 3. Contour-boring, facing, and turning of cast magnesium compressor housings are performed on this lathe provided with air-gage tracer.

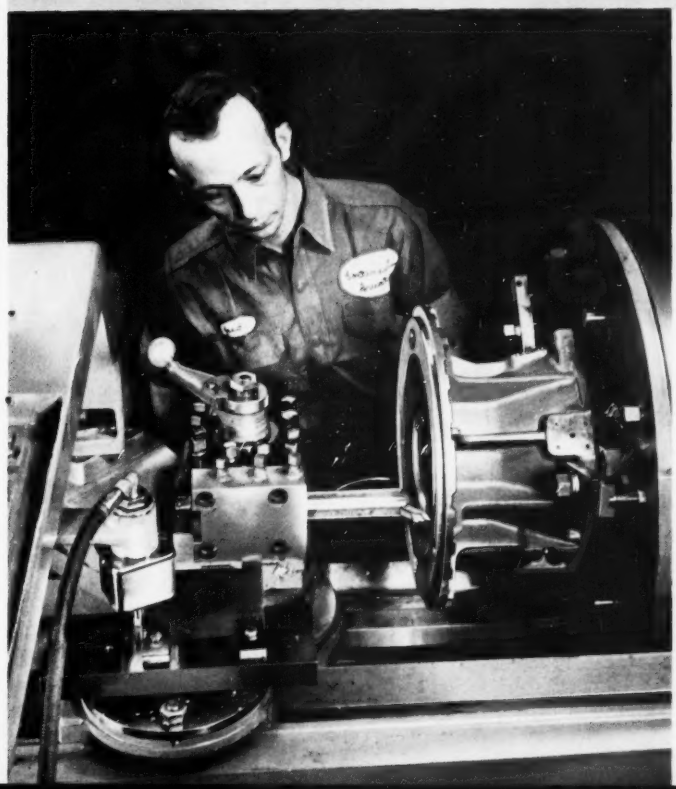


Fig. 4. Automatic milling machine with hydraulic tracer servo-control for contour-milling internal vanes in forged axial diffusers

Fig. 5. Four bolt holes in each of five parts are ground, holding size within 0.0006 inch, on this single-spindle internal grinder.

counterbalanced trunnion fixture was made large in diameter to insure accuracy of indexing at the bolt circle. The fixture is mechanically indexed, and tapered shot pins provide alignment before grinding. Both work-piece and grinding wheel are rotated, and the small-diameter grinding wheel is mounted on a solid-carbide quill for stiffness. Approximately 0.010 inch of stock is removed from the holes in this operation.

Another accurate grinding operation is performed on the Springfield vertical, universal grinding machine shown in Fig. 6. In this setup, the bore of a steel bearing liner (previously shrunk fit into the cast magnesium compressor housing) and adjoining face are ground. The compressor housing is clamped to the rotary table of the hydraulically operated machine, locating from the rear flange face. Hole size is maintained within plus or minus 0.0003 inch of the required diameter (approximately 3 inches), and parallelism and squareness of the face with relation to the bore are held to plus or minus 0.0005 inch. From 0.007 to 0.010 inch of stock is removed, using the periphery of the wheel for bore-grinding and its edge for face-grinding. The wheel is rotated at 9000 surface feet per minute, and the work at 500 R.P.M.

A total of thirteen surfaces—including the front and rear journal diameters and the labyrinth seal surfaces—on the complete rotor shaft assembly are finished on the Norton 14- by 36-inch cylindrical grinding machine seen in the heading illustration. Concentricity of all important surfaces (such as the bearing seats) is maintained within 0.0002 inch, and their sizes are held to plus or minus 0.0003 inch of the required diameter.

Among the many devices employed for testing and checking various parts of the gas turbine at various stages during their manufacture and assembly is a Pant-O-Scriber blade contour checker, Fig. 7, made by Optical Gaging Products. This equipment is employed to quickly and accurately inspect the airfoil contours of the buckets on both first- and second-stage turbine

Fig. 6. Vertical, hydraulically operated grinding machine for accurately grinding face and bore of a liner shrunk into cast compressor housing

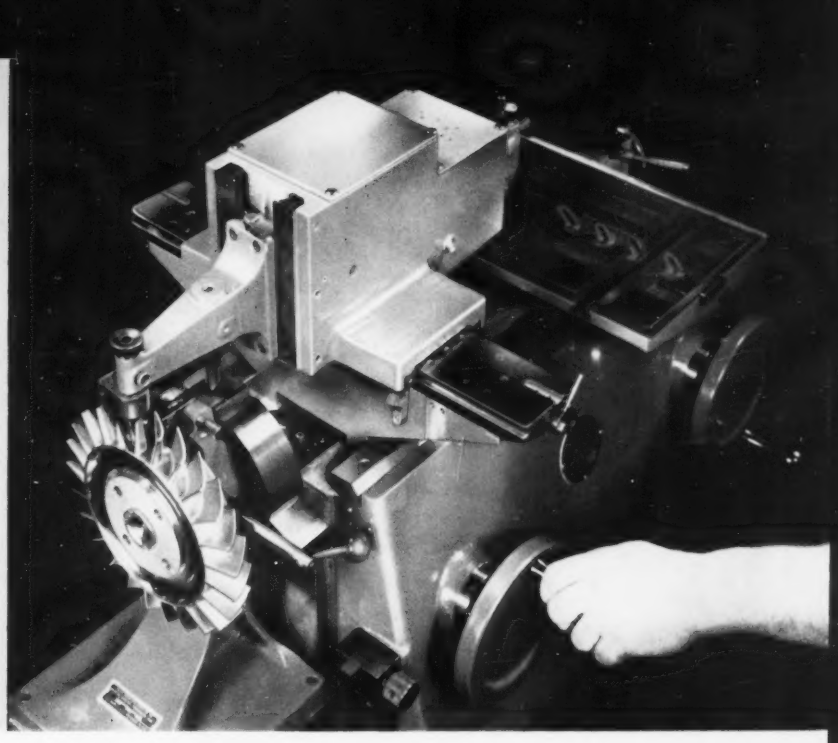


Fig. 7. Contour, thickness, and twist, of buckets on turbine rotor wheels are inspected rapidly and accurately on this Pant-O-Scriber.

rotor wheels. Each bucket is completely checked for contour, twist, thickness (at the tip, in the center, and near the root), and other characteristics. A permanent record of each bucket is obtained at the time of the inspection and filed for future reference.

The inspection device is equipped with a motor-driven head having a carbide tracing stylus that automatically traces both sides of the bucket contour at the three sections to be checked. A coordinated rotating scriber produces an accurate outline on a specially coated glass plate. The scribed plate is placed in a holding frame and projected on an opaque screen that has the required profile inscribed on it. Thus, a rapid comparison can be made, and the turbine bucket accepted or rejected.

Although the compressor rotor assembly and turbine rotor wheels are dynamically balanced during manufacturing, the whole rotating shaft is dynamically balanced after assembly. This is performed on an electronic dynamic balancing machine, Fig. 8. The shaft assembly is balanced within 0.10 inch-ounce.

After mounting the assembly in the balancing machine cradle, one end is locked and the assembly is rotated at 225 R.P.M.; then, the other end is locked and the cycle repeated. The operator views an oscilloscope screen to determine the unbalance. Stock is removed either from a balancing rim on back of the compressor rotor or from balancing rims on the turbine rotor wheels, by means of a portable grinder in order to correct any unbalance in the assembly.

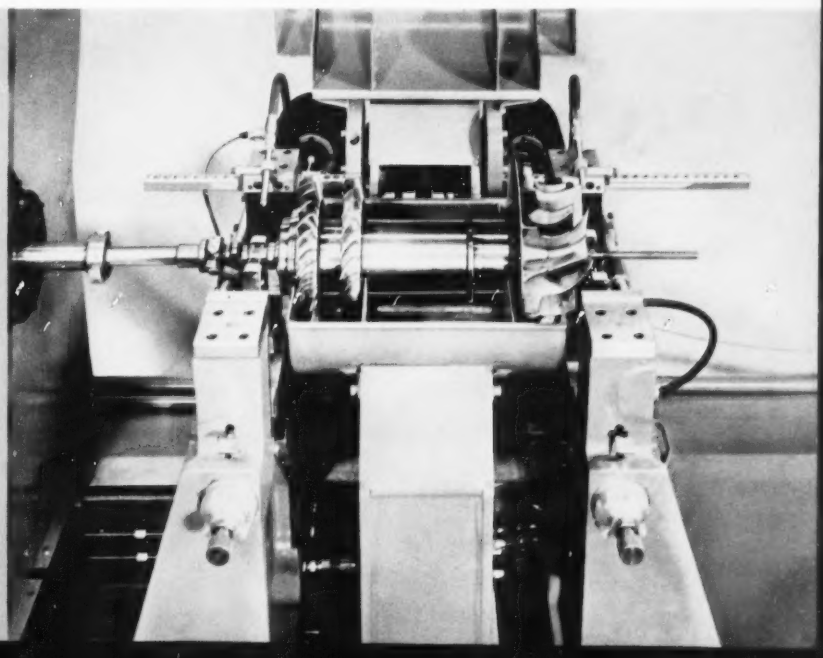
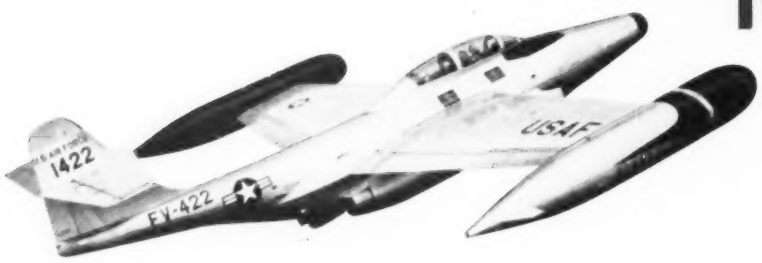
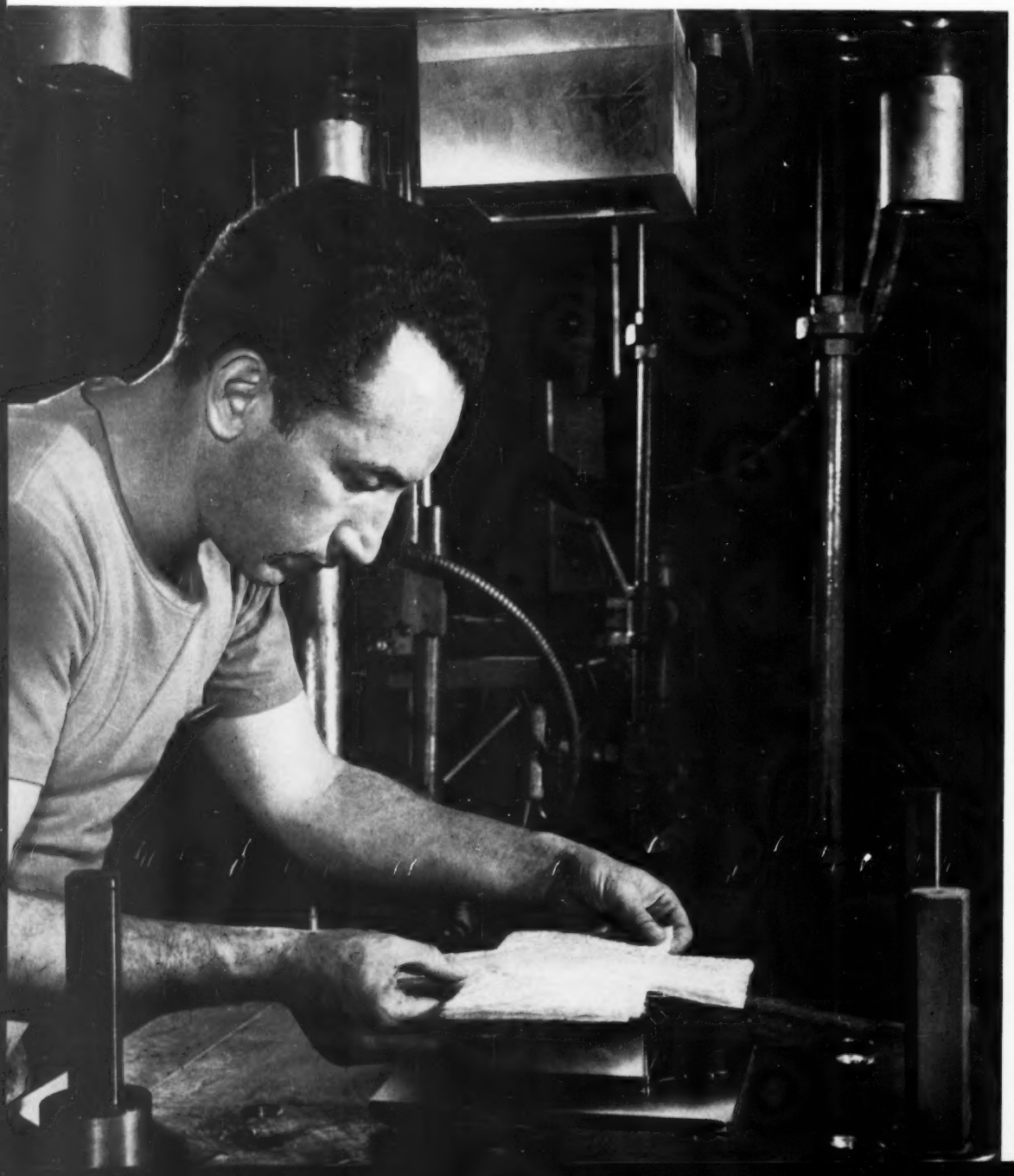


Fig. 8. This complete rotating assembly, consisting of compressor rotor, intermediate members, and turbine wheels, is dynamically balanced on this machine.

Northrop



Northrop Scorpion F-89D Interceptor



Molds Glass-Fiber Parts with Press Dies

The use of steam-heated metal die sets with conventional metal presses now is bringing speed, simplicity, and precision of detail to the molding of glass-fiber airplane parts

By ROBERT G. McINTOSH, Tool Engineer
Northrop Aircraft, Inc.
Hawthorne, Calif.

GLASS-FIBER mat moldings are proving to be an efficient and economical material for many non-structural parts of the United States Air Force's Scorpion F-89D all-weather interceptor. This rocket-armed, high-altitude, twin-jet fighter is made by Northrop Aircraft, Inc., Hawthorne, Calif.

Moldings are formed and cured on matched metal dies mounted on steam-heated platens in hydraulic presses. The random fibers, each 2 inches long, comprise a loosely constructed mat, approximately 1/8 inch thick. Initially, the mat is impregnated with a polyester resin; when formed in the dies, it produces a part 0.030 inch thick. A piece of raw material and the work-piece produced from it are shown in Fig. 1. The punch and die used for this particular part appear in Fig. 2. For greater thickness, added layers of mats are used with increased clearance in the dies.

Moldings with complex configurations, like the one in Fig. 3, usually require "preforms." The chopped glass fibers are drawn onto developed perforated screens that are separated on the rotating table of the preforming machine. Air from a fan below the table holds the glass to the screens while a binder is sprayed over the shape. The size and shape of the part determine the number of screens that can be accommodated on the table. This operation is performed automatically, requiring only one or two minutes per cycle. While still on the screens, the parts are then placed in an oven for a quick cure of the binder. Now called preforms, they are removed from the screens, ready for the press cycle.

A typical punch and die used in forming a glass-fiber part are shown in Fig. 4. The punch, machined to the desired dimensions of the inside of the material and highly polished, is usually completed first. The die is then machined to match the punch, with a clearance for the material thickness. Here, a tolerance of plus or minus 0.010 inch is maintained. This tolerance is equivalent to the variation in material thickness of the completed part.

At Northrop, dies have been made of Kirksite, cast aluminum, aluminum plate, mild and heat-treatable steel plate, and cast steel. Originally, moldings were only formed and cured in the dies and subsequent operations were required for any trimming, drilling, or routing that the part required. Today, these operations are frequently provided for in the design of the dies. Trimming is performed through the addition of steel edges to the punch and die members, with a clearance between them of from 0.0015 to 0.004 inch. Piercing punches of various sizes and shapes have been incorporated in the dies, and the cavities for these punches are held to the same clearance tolerance as the trim edges.

Trim edges can be seen on the punch and die members in Fig. 5. They are made from flame-hardenable steel. On the punch, the edges extend out from the contour the thickness of the material. In the closed position, the trim edges of the die have an overtravel of 0.060 inch to provide a satisfactory shearing action.

Most, but not all, of the flash is removed, as can be seen from the condition of the part immediately to the right of the punch in the illustration. This is done intentionally, since occasionally parts do stick in the dies, and if the excess

Fig. 1. A piece of the loose glass-fiber mat material and a completed part for the airplane

material is completely sheared away, it is difficult to remove the work without damaging it. An effort is presently being made to increase the clearance between the trim edges to a minimum of 0.005 inch to make certain that the flash will not be completely parted. The cured part and flash are taken out of the press together and the flash finally separated, using a knife or breaking it off by hand while other parts are in the process of being formed.

Piercing punches are added in the last stage of die construction, the die having been matched, the trim edges fitted, and leader pins and stops located. A lay-out is made, and the holes to retain the punches are drilled or bored through one of the die members. The piercing punches have a press fit in these holes, backing up against set-screws. Corresponding cavities are drilled in the other member to a depth equal to the material thickness, plus 0.010 inch. The depth at which the punches enter the cavities is controlled by the set-screw adjustment. The desired result is to partially shear the slugs, much like the knock-outs in an electrical box. The slugs can be easily removed once the work has been taken out of the die.

To allow for multiple loading in the presses, as production schedules dictate, the over-all heights of the dies are machined to even-inch increments. The steam-heated upper and lower platens to which the die members are bolted are thermostatically controlled not to vary more than

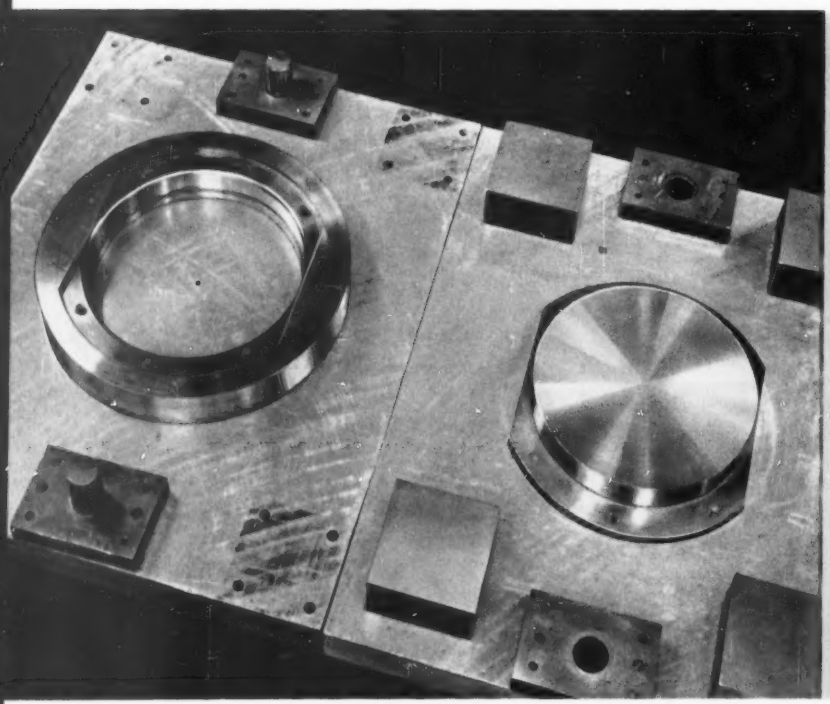


Fig. 2. These dies produced the part in Fig. 1. Piercing punches are contained in the die member.

Fig. 3. A typical complex mat molding that requires a "preform."

10 degrees F. For producing polyester reinforced glass-fiber mat moldings, platen temperature is set for 250 degrees F. The press cycle for curing, punching, and shearing varies from three to five minutes.

After the die is proved, the trim edges, piercing punches, and punch cavities are flame-hardened. Chromium-plating or nickel-dipping has been used to improve the parting surface of the dies, and either process is definitely recommended for high-production runs. However, for many airplane parts a good polish on the die surfaces suffices.

A mold release, or parting agent, is added to the polyester mix to reduce sticking in the dies. In many cases, lubrication of die surfaces before each press cycle eliminates any likelihood of sticking. Occasionally, only one die member is lubricated, causing the part to adhere to the other member so that it may more readily be removed.

In order to reduce over-all cost, standard die sets have been designed and fabricated. Those available at present are 12 by 35, 24 by 24, and 35 by 35 inches. Larger sizes will be used, if and when required. One of the die sets is shown in Fig. 6. It is equipped with four diamond pins in the corners to allow for expansion. Leader-pin bushings are designed with a 0.375-inch wall, 1.750-inch inside diameter, and 4-inch shoulder. Slip fit collars having a 0.375-inch wall and 2-inch height are placed over the diamond pins. The collars provide stops in each corner of the die sets to maintain a shut height of 6 inches, plus or minus 0.003 inch. Other collars, 3 and 4 inches long, can be used to obtain shut heights of 7 and 8 inches.

There is a 1/2-inch diameter dowel-pin located centrally in both the upper and lower parts of the die set. These pins serve to align the die inserts, which have a corresponding 1/2-inch diameter hole through their centers. Another 1/2-inch diameter dowel-pin, mounted in a block, fits a slot in the die set. The pin can be adjusted to accommodate inserts of different size. Because the block is free in the slot, it is able to slide as the insert heats and expands. The die sets are drilled and tapped with a pattern of holes on 4-inch centers for 5/8-inch 11 hold-down bolts.

Die inserts, such as those seen in the heading

Fig. 1. The glass-fiber part is 0.030 inch thick when molded. The original mat was 1/8 inch thick.

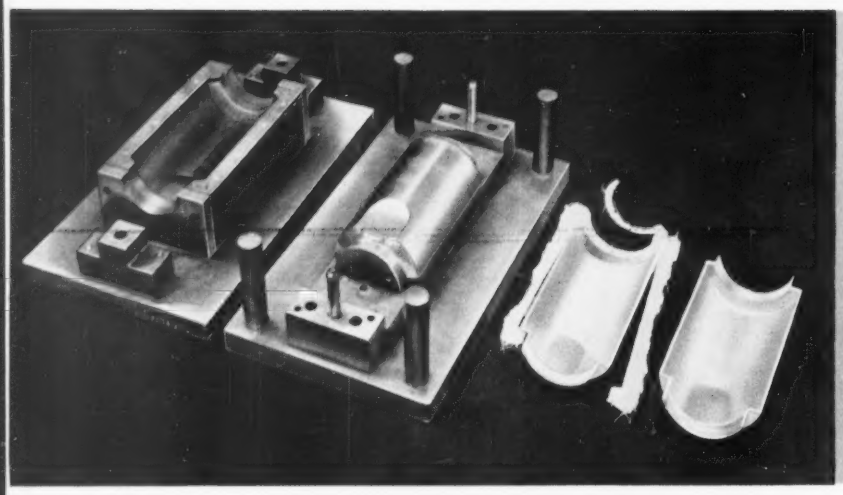


Fig. 5. This punch and die are equipped with trim edges. The flash is almost completely severed in the press cycle.

illustration, are fabricated and matched as already described, except that such blocks are mounted in the die sets without ordinarily requiring leader pins, bushings, or stops. The use of inserts offers substantial savings in tool fabrication, since jig boring for leader pins and bushings is eliminated. There is also a savings in set-up time since the standard die sets can remain in the press and only the inserts themselves need be interchanged.

In comparison with a former glass-fiber fabricating method used by the company, the economies offered by mat molding seem tremendous on production runs of 500 parts, with the cost of the tooling completely amortized. Previously, the cost of slush mold dies, plaster breakaways, hand lay-up, vacuum bagging, and oven curing all had to be carried. Although metal dies are more expensive than slush mold dies and breakaways, costs are about equal for a run of approximately 100 parts.

Added savings will probably accrue from the use of epoxy resin inserts for the die member. Preliminary experimentation at Northrop with this material consists of casting the epoxy in a steel weldment around an existing punch that has been coated with a high-temperature wax built up to the thickness of the part.

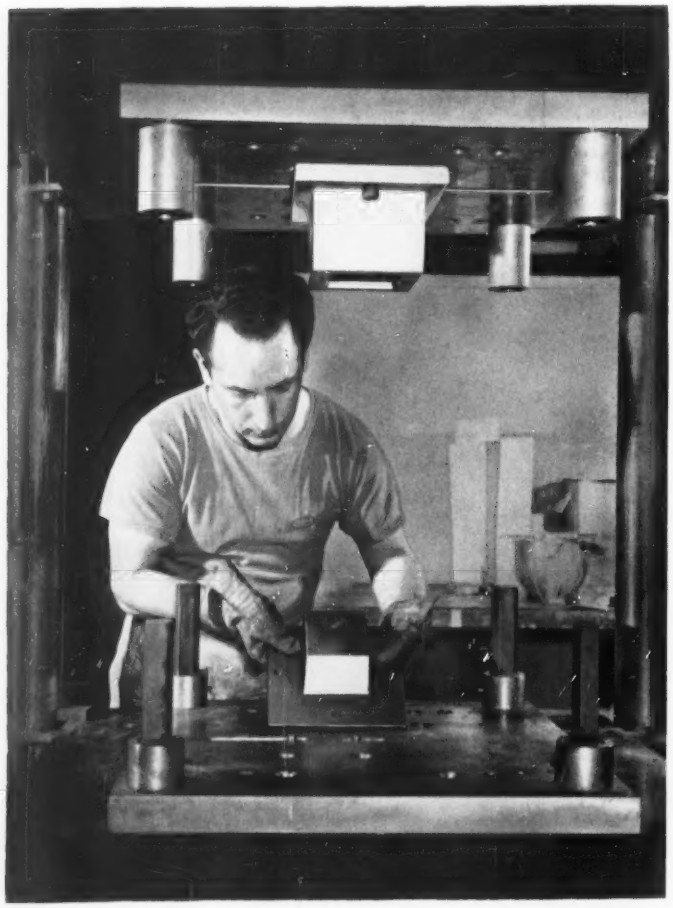


Fig. 6. Locating the insert over the two dowel-pins in one of the standard die sets

Splines Produced Rapidly by New Cold-Rolling Process

ACCURATE involute splines, oil-grooves, serrations, and other similar shapes can be quickly produced on external parts by means of an important metal-working process announced by the Michigan Tool Co., Detroit, Mich. In this process, splines or similar shapes are cold-rolled on the work-piece between the forming racks of a Roto-Flo hydraulically operated spline-rolling machine.

Splines can be produced up to thirty times faster—being completely formed at any desired position along the shaft in a few seconds instead of the minutes previously required. In addition to the close tolerances maintained and the fine surface finish of the resulting splines, the cold-working produces high strength. Tests to date indicate that parts produced with rolled splines will withstand high-torsion loads, thus permitting the use of fine-pitch splines to replace deeper, coarse-pitch splines for many different applications.

Flexibility of the process is exemplified by the collection of typical work-pieces shown in Fig. 1, on which splines were formed by the Roto-Flo process in an average forming time of three and one-half seconds. These splined shafts vary from 7/8 inch to 1 5/8 inches in diameter, and the spline lengths range up to 1 3/4 inches. An outstanding feature of the process is that teeth can be formed right up to a square shoulder, as seen on the helically splined part at the left center, and the straight-splined part at the top center.

Good strength and bearing surfaces are obtained because a recess adjacent to the shoulder is not required for tool clearance with the Roto-Flo method and the shoulder is not damaged in any way. Photomicrographs of polished sections cut through teeth cold-rolled by this process show that the actual flow of metal conforms with the contour of the teeth. Since the tooth loads are normal to grain flow, greater strength is obtained along the working surface of the spline teeth.

A Roto-Flo spline roller machine employed for this process is seen in Fig. 2. These machines are now being made by the Michigan Tool Co. in three sizes—to accommodate racks 25, 36, and 50 inches long. The machines consist essentially of an extremely rigid C-shaped frame, and two horizontal, reciprocating slides that carry the rack type forming tools. The two slides, mounted one above the other, are coupled together by a master rack (located behind the rack forming tool) on each slide and a connecting gear as shown in the end view of the machine, Fig. 3. Two hydraulic cylinders, one for the feed stroke and the other for rapid return, reciprocate the lower slide. Driving power is transmitted from the master rack on the lower slide, through the connecting gear to the master rack that is mounted on the upper slide.

Fig. 1. Typical parts showing flexibility of new cold-rolling process for producing splines, oil-grooves, serrations, or other similar shapes at any position along work-piece. These splines were formed in average cycle time of three and one-half seconds. Several parts show that teeth can be formed right up to a square shoulder.

Fig. 2. Roto-Flo hydraulic spline roller machine made by the Michigan Tool Co. The work-piece is held between centers under an over-arm support, and the two rack type forming tools are mounted on horizontal reciprocating slides.

Parts on which splines or other shapes are to be formed are positioned horizontally between the tool racks and at 90 degrees to them. The work-piece is supported between centers, or by other suitable means, so that the part is free to be rotated about its own axis by the reciprocation of the rack forming tools. Since metal is displaced and not removed in this process, the parts are usually turned to the required pitch diameter before forming.

Forming racks of a Roto-Flo spline roller are seen in Fig. 4 about to engage the periphery of a shaft to produce a helical form spline. Fine starting serrations at the beginning of both racks grip the shaft and start it rotating between the racks. The tapered racks are designed to press deeper and deeper into the work-piece as they are fed toward each other, until full depth is reached. The final few revolutions of the shaft, Fig. 5, are made with the forming rack teeth at full depth.

When the splines are completed, the operator removes the shaft and the rack forming tools return to their starting positions. Electrical controls of the machine are safety interlocked so that the tools cannot be returned until the work-piece has been removed. Also, the feed stroke of the tools cannot begin until a new part has been properly located between centers and the operator's hands are out of the working area. An automatic coolant system is provided for cooling

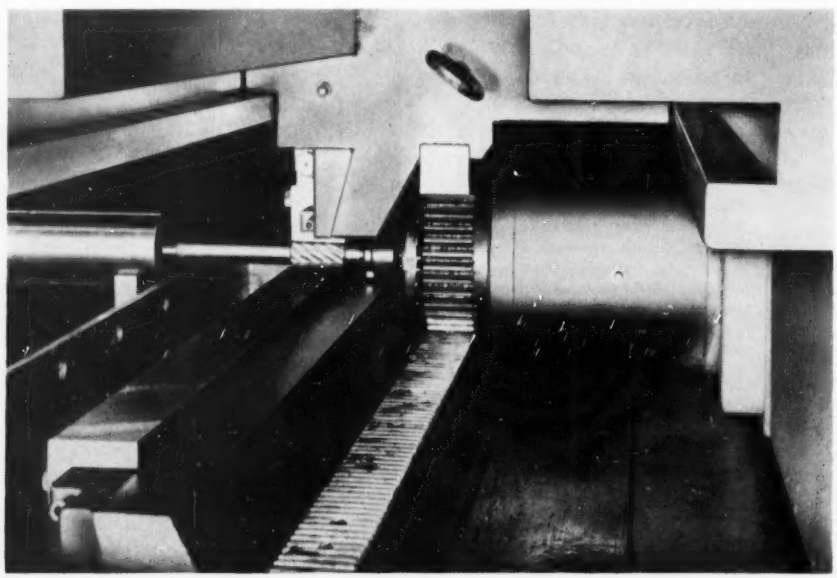


Fig. 3. End view of spline roller machine shows how two slides are coupled together by a master rack on each slide and a connecting gear. Lower slide is reciprocated by two hydraulic cylinders—one for feed stroke and the other for rapid return.

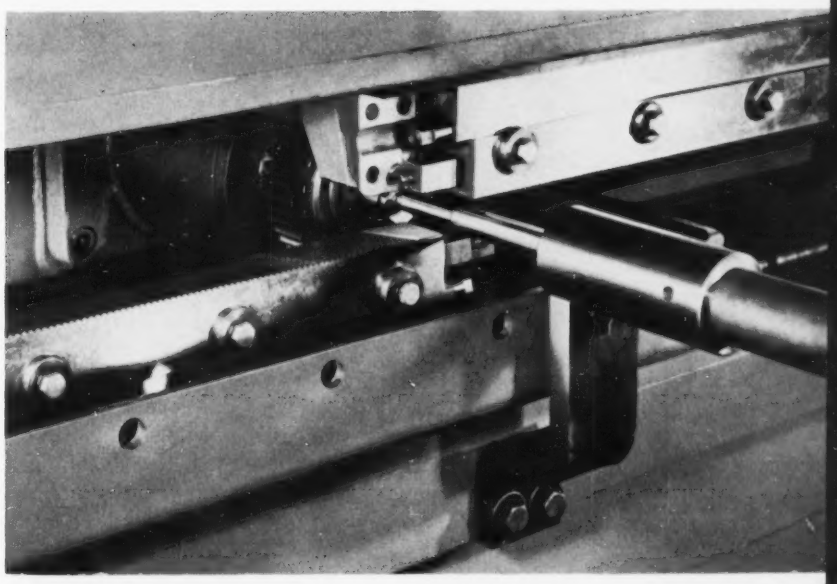


Fig. 4. Rack forming tools are about to engage periphery of shaft to produce a helical form spline. Fine serrations at beginning of both racks start shaft rotating about its own axis and between the racks.

the tools and work when required, but most operations can be performed dry.

The tapered design of the rack forming tools permits them to be easily adjusted toward or away from the center of the work-piece to accurately control the size of the spline or other shape being produced. Also, the tools can be adjusted longitudinally on the slides to gain correct relationship with the axis of the part to be formed. Tools are made from a high-carbon, high-chromium steel that is hardened and ground. Racks are ground in pairs on a special machine to insure extreme accuracy in spacing, pressure angle, and helix angle of the teeth. Long tool life is expected, since all stresses are compressive and not in shear.

Special automatic loading and unloading devices have been designed to handle high-volume production on Roto-Flo spline-rolling machines. One case history illustrating the high production possible was the forming of a spline 1 1/8 inches in diameter and 1 1/4 inches long on a shaft in three seconds. The shafts were made from S A E 1037 steel ranging in hardness up to 41 Rockwell C. Return stroke of the slides, with the machine empty, takes two seconds, and automatic handling of the parts will require less than four seconds. Surface finish obtained on the cold-rolled spline was 3 to 5 micro-inches r.m.s., and accuracy was maintained within a variation of 0.0008 inch from part to part as determined by accurate measurements taken over pins.

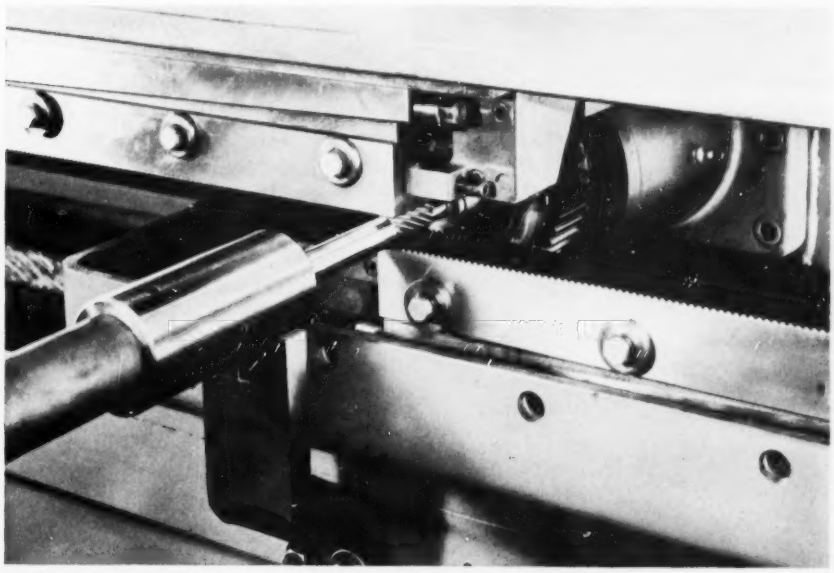


Fig. 5. Here, cold-forming of spline is practically complete. Last few revolutions of shaft are made with the forming rack teeth at full depth.

Jet-Engine Overhaul Reduces Defense Costs

(*Continued from page* 211)

of this machine has tapered wedges for rounding the flanges. Subsequently, a pie-section fixture is substituted, and a tapered plug is screwed into the center of the fixture to expand the turbine nozzle diaphragm and increase its outer bolt circle diameter.

One of the many welding operations performed in overhauling and repairing parts of the jet engine is illustrated in the opening illustration. A turbine nozzle diaphragm is shown mounted on a welding positioner, and cracks are repaired and replacement blades are welded into position. Inert-gas shielded-arc welding is employed with a non-consuming electrode, and the electrode, arc, and weld area are blanketed by an inert gas. When it is necessary to replace a bearing seat insert in the aft frame of the jet engine, welding must be performed with the aid of a mirror.

If the bearing surfaces on the turbine rotor shaft have been worn below the allowable diameter, these surfaces are built up by chromium-plating and then reground. Before reassembly in the overhauled jet engine, the turbine rotor shaft and wheel assembly is given a final inspection

Fig. 6. Special disassembly machine in which half-rings holding the stator vanes are pneumatically pushed from the compressor casing one at a time.

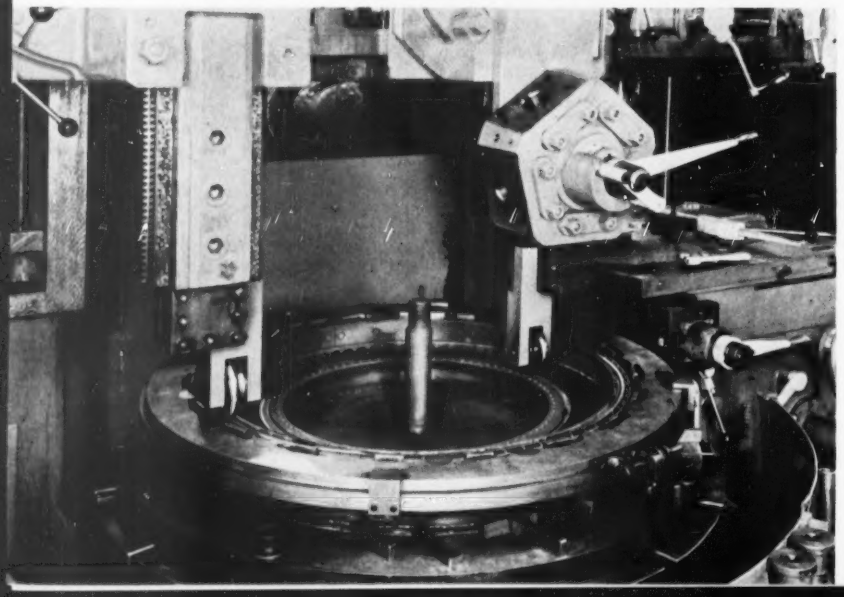


Fig. 7. Roll-forming set-up on a vertical turret lathe for reshaping the bolt flanges on the turbine nozzle diaphragms of jet engines.

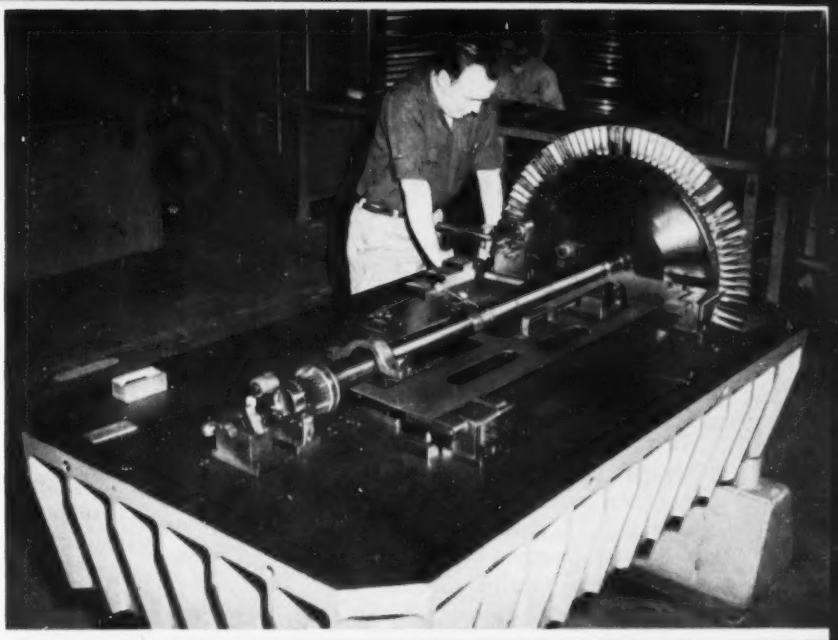


Fig. 8. Special surface-plate checking fixture is used for final inspection of the turbine rotor shaft and wheel assembly.

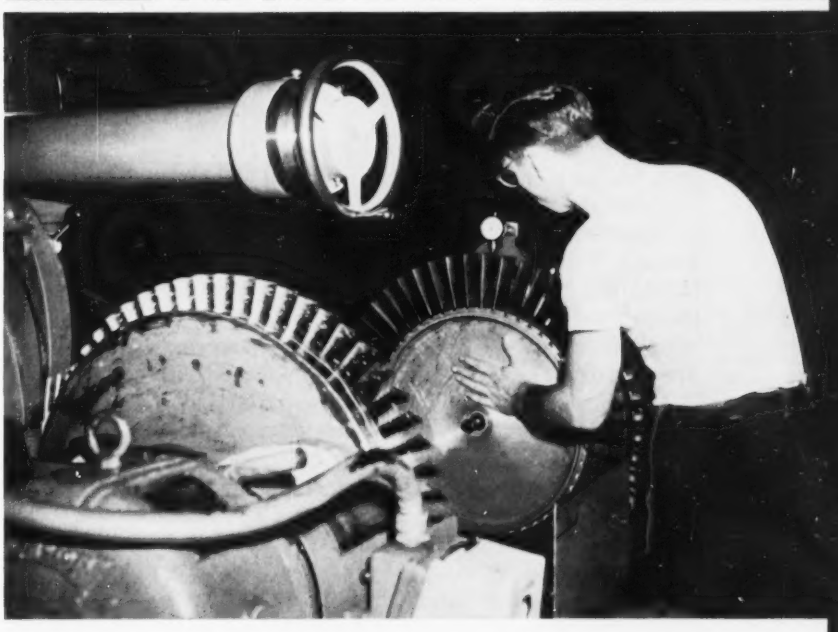


Fig. 9. External tips of the new compressor rotor blades are ground on this machine. Double work-head permits loading one assembly while grinding another.

on the special surface-plate checking fixture seen in Fig. 8. Dial indicators are employed to inspect the concentricity, run-out, and misalignment of critical surfaces. Templates and snap gages are used to check required contours and important diameters. Also, the assembly is visually inspected to detect nicks, burrs, or other surface irregularities.

Bearing surfaces on the turbine rotor shaft must be maintained within a total tolerance of 0.0004 inch. Concentricity of all three of these surfaces has to be held within 0.001 inch of each other. The outside diameter formed by the peripheries of the turbine buckets is maintained within 0.005 inch of the required size.

During reassembly of the compressor rotor discs, it is often necessary to replace some of the blades. The external tips of new rotor blades must be ground after they have been mounted on the discs, and this is accomplished on a cylindrical grinding machine, Fig. 9. This special grinder is equipped with double work-heads—one head being mounted at each end of the reciprocating table on the machine. With this arrangement, one bladed compressor disc can be loaded or unloaded while another is being ground, and practically continuous grinding is possible.

After grinding the blade tips, the compressor rotor disc assemblies are dynamically balanced to within 24 gram-inches. Stock is bored from the inside diameter of the disc hub if the assembly is out of balance. In reassembling the compressor rotors, the aluminum-alloy discs are heated to a temperature of 320 degrees F. in electric ovens, and mounted on the rotor shafts by means of hydraulic presses.

Hydraulic Problems Discussed at Production Machine Tool Forum

A TWO-DAY Production Machine Tool Hydraulics Forum sponsored by Vickers Incorporated and recently held in Detroit, Mich., was an outstanding success. This meeting brought together representatives of many major users and manufacturers of production machine tools, and Vickers engineering and service people to discuss common design, operating, and maintenance problems pertinent to hydraulic systems and equipment. Free exchange of ideas and experiences among members of these groups solved many problems, and accomplished much toward a common understanding of important details of hydraulic applications.

In the opening address, H. L. Tigges, executive vice-president of Baker Brothers, Inc., Toledo, Ohio, and president of the National Machine Tool Builders' Association, commended Vickers for sponsoring the Forum. Mr. Tigges described modern trends in machine tool design, and deplored our present depreciation policy as a deterrent to modernization. If the relaxation of restrictions now being considered by Congress are approved, he stated, not only would modernization be accelerated, but our standard of living would be advanced and defense strengthened.

J. H. Mansfield, consultant for Greenlee Bros. & Co., Rockford, Ill., and Gordon Swardenski, assistant manufacturing manager, Caterpillar Tractor Co., Peoria, Ill., shared the duties of moderator and conducted the meetings. Mr. Mansfield served as representative for the machine tool builders, while Mr. Swardenski represented the machine tool users.

Hydraulic Circuit and System Problems

In discussing hydraulic circuit and system problems, advantages and disadvantages of having either a single power unit for all functions on a transfer machine, or separate hydraulic power units for each station, were set forth. It was the consensus of opinion that while separate power units do have certain advantages, their use would raise the cost of the machine, increase the maintenance problems, and require more floor space.

The need for means of attaching pressure gages at necessary check points in hydraulic circuits was emphasized. Suggestions offered for eliminating shock included cushions, dash-pots, tapered lands on valve spools, throttle grooves, progressive chokes, accumulators, high-pressure hose, and faster-operating valves.

Valve Design and Motor Applications

Contamination was felt to be the main cause of solenoid failure in solenoid-operated valves. Insufficient protection by the enclosures and loss of covers are responsible for contamination. Suggestions to avoid the loss of covers included the provision of hinges or chains, or the use of clear plastic covers so that they would not have to be removed to permit inspection.

Fluid motors are being used by several manufacturers for driving machine-tool spindles, and they have been found satisfactory, particularly for driving the high-speed spindles of honing or grinding machines. A fluid motor drive has been found comparable in cost with a motor-generator set for speed variation when the drive requires 7 1/2 H.P. or more. Also, it was reported by several manufacturers that they are successfully using a fluid motor with a rack-and-pinion to impart a reciprocating motion to a tool-slide with a fast return stroke.

A comprehensive preventive maintenance program, strict adherence to recommendations of equipment and oil suppliers, and the employment of trained maintenance personnel are essential to successful hydraulic applications. To assist in the special training of hydraulics maintenance personnel, Vickers conducts a customer personnel training school. More than 800 employes from 400 companies have taken the course, which consists of 60 per cent classroom and 40 per cent laboratory work.

Suggestions for improved means of removing foreign particles from hydraulic fluid included the use of magnetic plugs, baffling in the reservoir tank to increase the settling action, and more adequate provisions for cleaning the tanks. One machine tool manufacturer suggested a gage connected across the filter to measure the pressure drop. A red line on the gage indicates when the filter should be changed.

A representative of one oil company stated that an inhibited, premium-quality oil in a hydraulic system should last indefinitely. However, contamination from soluble cutting oil is dangerous, and the hydraulic oil should be replaced when its neutralization factor reaches a certain point. While the odor, appearance, or feel of the

oil is sometimes sufficient to determine its condition, it is safer to periodically take advantage of the laboratory testing facilities offered by most oil suppliers.

Suggestions for controlling the temperature of the oil in hydraulic systems included exposing all sides of the storage tank to the atmosphere, and the use of thermostat-controlled heaters. However, care must be exercised in heating the oil, as a 20-degree F. rise in oil temperature will approximately double the rate of oxidation, depending on the quality of oil. J.I.C. standards recommend a maximum temperature of 130 degrees F. in the reservoir tank.

Fire-Resistant Fluids

Dr. William Millett of the Carbide and Carbon Chemicals Co. presented a summary of benefits derived and problems resulting from the use of fire-resistant fluids in hydraulic systems and equipment. The principal types of non-flammable fluids are water-based types, phosphate-ester compounds, halogenated types, soluble-oil emulsions, and blends of these types.

Problems encountered with the use of fire-resistant fluids are their relatively high cost; strong solvency for varnishes and paints; the adverse effect on packings of non-aqueous types; the care needed to prevent contamination; and the toxicity of some types. Although conventional seals can be used for hydraulic systems using water-base fire-resistant fluids, butyl rubber seals are required for phosphate-ester fluids. No all-purpose seal has yet been developed that is suitable for use with both hydrocarbon oils and fire-resistant fluids.

Fittings, Tubing, and Hose

Several users reported good results in applying flexible hose as permanent piping rather than rigid tubing on machine tools. One advantage has been minimizing the effects of shock. Another representative at the Forum commented that excellent results have been obtained in using quick-disconnect, self-sealing couplings on press type welding machines, with little pressure drop.

Many firms are using non-flare type fittings exclusively because of the inconvenience of making machine flares, and unsatisfactory results experienced with hand flaring. Other companies use flared fittings, but all flares are made by machine rather than by hand.

Proficiency in bench work is a major objective of a four-year tool- and die-maker apprenticeship program at John Volkert Metal Stampings, Inc., Queens Village, N. Y. Foreseeing a continuing shortage of skilled personnel, the company recently instituted the training program to meet the needs of its growing business. Under the direction of a full-time supervisor, apprentices also learn to set up and operate basic machine tools, constructing simple tool and die elements used in actual production. Related classroom theory two evenings a week is provided by an instructor from Pratt Institute. The program has the approval of the New York State Apprenticeship Council and the National Tool and Die Manufacturers Association. The Volkert concern is an electronic parts supplier.

Gear Manufacturers Hold Thirty-Eighth Annual Meeting

CENTERING their attention on active projects for new or revised standards, members of the American Gear Manufacturers Association convened at the Homestead, Hot Springs, Va., from June 6 to 9, inclusive. At this thirty-eighth annual meeting, Richard B. Holmes, general manager of the Philadelphia, Pa., plant of the Link-Belt Co., was elected president of the Association for the current year; Marvin R. Anderson, executive vice-president of the Michigan Tool Co., Detroit, Mich., was elected vice-president; and Fred R. Eberhardt, president of the Eberhardt-Denver Co., Denver, Colo., was re-elected treasurer.

Mr. Holmes has been active in AGMA for a number of years, serving as chairman of several committees, as a member of the Executive Committee, as treasurer, and in the past year, as vice-president. Mr. Anderson's past Association activities included membership on the Executive Committee and chairmanship of the Plant Management Committee. In addition to being treasurer last year, Mr. Eberhardt has in the past been active on several of the engineering committees and also served as a member of the Executive Committee.

Newly elected members of the Executive Committee, serving three-year terms starting June, 1954, are LeRoy R. Brooks, president of the Tool Steel Gear & Pinion Co., Cincinnati, Ohio; John A. Sizer, president of the Industrial Gear Mfg. Co., Chicago, Ill.; T. F. Scannell, general sales manager of the Falk Corporation, Milwaukee, Wis.; and Ralph E. Rawling, president of the Rawling Gear Works, Worcester, Mass.

A highlight of the annual meeting was a symposium conducted by the Gear Rating Coordinating Committee, the subject being "Fatigue Strength Characteristics of Gear Teeth." Panel members included E. J. Wellauer, Falk Corporation; D. W. Dudley, General Electric Co.; and Wells Coleman, Gleason Works. J. E. Van Acker, Gould & Eberhardt, presented a paper, "The Span System of Measuring Involute Gear Tooth Size." Another paper, "A New Look at Worm-Gear Hobbing," was presented by Ernest Wildhaber, gear consultant. The Industry Problems Division conducted an interesting symposium on "Management Controls."

At the annual banquet, the 1954 Edward P. Connell Award was given to Admiral Paul F. Lee, United States Navy, retired, vice-president of Gibbs & Cox, Inc., New York City, naval architects and marine engineers. Admiral Lee's contributions to the design and manufacture of naval gearing were of inestimable aid to the gear industry during World War II, when he was assigned to the Bureau of Ships, in charge of engineering. The Award, in the form of a silver medallion and a scroll, was presented by Walter L. Schneider, vice-president of the Falk Corporation and past president of AGMA.

(Left to right) Richard B. Holmes, newly elected president of the American Gear Manufacturers Association; Marvin R. Anderson, vice-president; and Fred R. Eberhardt, treasurer

TOOL ENGINEERING *Ideas*

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

Producing a Helical Keyway in Bore of Long Shaft

By W. M. HALLIDAY, Southport, England

The problem of producing a helical keyway in the long hollow shaft shown in Fig. 1 was solved in a unique manner. A process of building up was employed, whereby two sections of cylindrical steel tubing of different diameters were fitted one within the other after an appropriate helical slot had been milled through the inner member.

The outer tube *A*, shown at X in Fig. 2, is parted off in a lathe to its specified length plus 1/32 inch for subsequent finishing. A series of 1/4-inch diameter holes *B* are then drilled through one wall. The holes must be carefully staggered around the periphery to avoid running into the path that the helix will follow in the inner tube. After drilling, the bore is deburred.

A second piece of tubing *C*, shown at Y in Fig. 2—with a bore diameter corresponding to the inside diameter of the finished part in Fig. 1—is parted off to a length of approximately 19 inches. This part is centerless ground to a press fit within *A*. It may be noted that the wall thickness of *C* is the same as the depth of the keyway.

The next step consists of pressing tube *C* into the outer member *A* so that it extends an equal distance on each side. Holes *B* are then transferred to the inner tube to form shallow dimples *D*. An index line should be scribed across one end of the outer tube in line with a similar mark scribed axially on the projecting periphery of the inner tube. This is done to facilitate the realignment of dimples *D* with holes *B*.

The inner tube is then removed and mounted on a mandrel designed for a light push fit within the bore. A cross-pin secures the work to the mandrel through a previously drilled hole *E*,

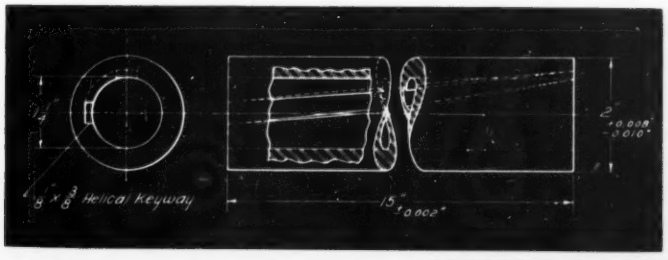


Fig. 1. (Left) A long, small-bore shaft in which it was necessary to produce the helical keyway shown.

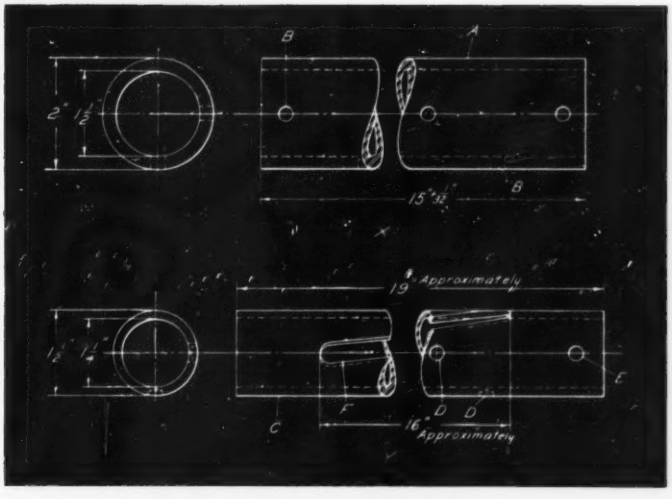


Fig. 2. A tubing liner, view Y, into which a helical slot has been machined, is pressed into a larger tube, view X, to form a single built-up shaft containing a helical keyway.

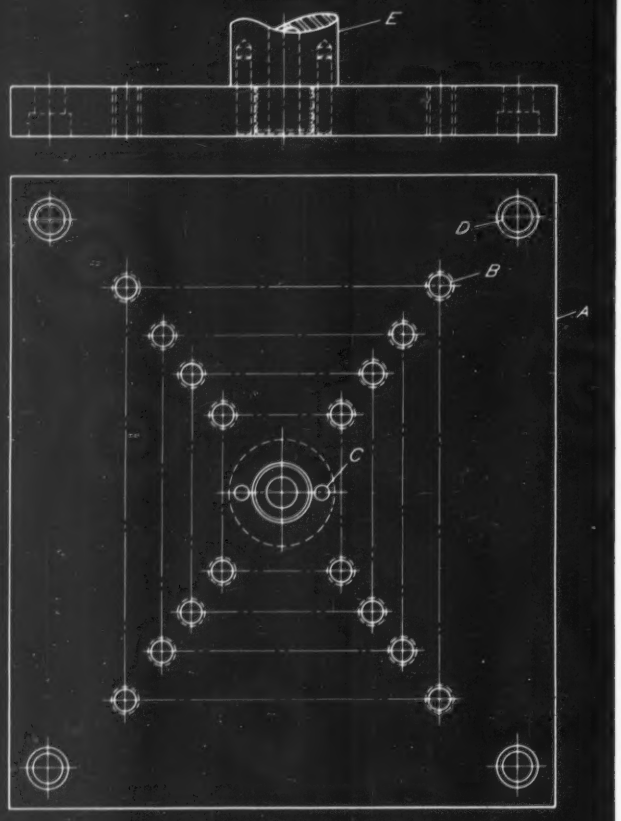


Fig. 1. Adapter allows many sizes of punch-holders to be interchangeably mounted on the ram of a punch press.

which is approximately 5/16 inch in diameter. This hole passes diametrically through both side walls close to one end of the part.

The mandrel is mounted between the centers of a dividing head which is bolted to the table of a vertical milling machine. To produce the helical slot *F*, the dividing head is geared to the table lead-screw. The slot should be end-milled approximately 16 inches long through one wall, and also should be equidistant from the ends.

After the milled tube is taken off the mandrel, all burrs must be removed from the edges of the keyway. Then a rectangular strip of soft brass or copper is packed into the keyway to prevent distortion when the tubes are pressed together.

Member *C* is again pressed into the bore of the outer tube *A*, using the scribed lines as an alignment guide to bring dimples *D* into position with their respective holes *B*. The holes are then filled with brazing metal or, if a stronger bond is preferred, welding metal. A fine-pointed jet should be used on the torch to localize the heat.

After removing the excess brazing metal from around the holes, the projecting ends of tube *C* are sawed off and the packing strip removed. The assembled unit is then held in a lathe chuck to face the ends square to the required over-all length. The final operation consists of passing the assembled unit through a centerless grinder to clean up the outside diameter and bring it within the blueprint tolerance.

Adapter for Press Ram Saves Time in Changing Dies

By WILLIAM C. BETZ, New Britain, Conn.

Changing dies on a punch press from job to job usually proves to be a time-consuming operation. Setting-up time may be substantially reduced by employing the adapter here shown in conjunction with slightly modified punch-holders of standard die sets.

The adapter *A*, Fig. 1, is an oil-hardening steel plate machined large enough to cover the face of the press ram, and to a thickness of approximately 1 1/8 inches. Two diagonal rows of holes *B* are jig drilled and then tapped for coarse-series threads. Holes *C* should be drilled and reamed for two dowel-pins. The four corner holes *D* are located from the ram of the press, then drilled and counterbored for hold-down

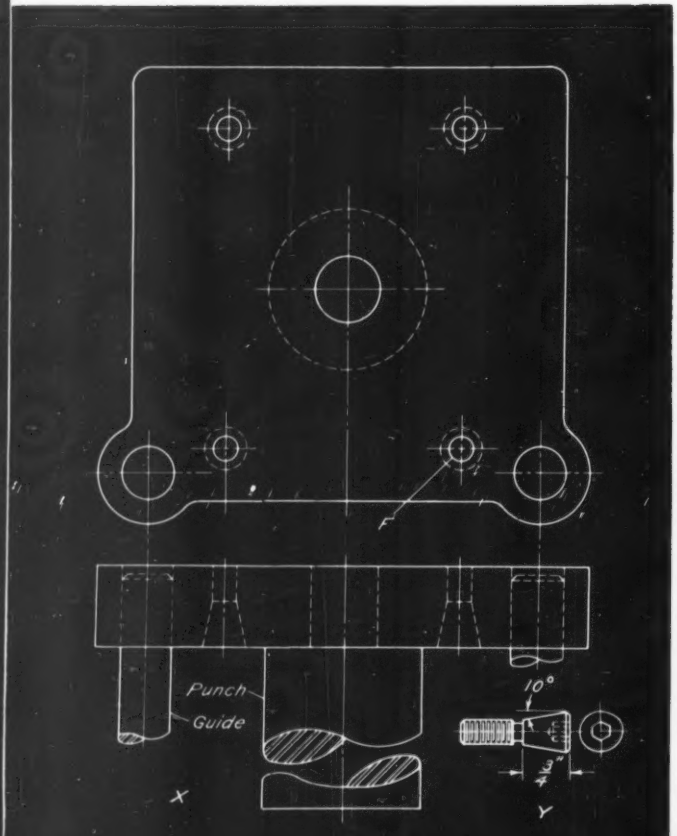


Fig. 2. Die sets without shanks may be used with the press ram adapter shown in Fig. 1 by the addition of four mounting holes, as shown at X. The holes are countersunk to receive special screws similar to the one at Y.

bolts. Hardening from 48 to 52 Rockwell C follows, after which the plate is ground on both faces.

Shank *E*, one end of which is step-turned and threaded, is screwed into the center tapped hole in the adapter. The previously drilled dowel holes are extended into the shoulder of the shank, and dowel-pins are inserted. On presses with ram faces that are machined with dovetails, the shank is first fitted to the ram, following which the adapter is screwed in place and doweled. In both cases, the shanks are left unhardened.

The jig used to drill the diagonal rows of holes should be sturdily constructed. Double bell-mouthed bushings are recommended since the tool will be used in an inverted position for drilling a corresponding group of four holes through the punch-holder. By using this jig for drilling the mounting holes *F*, shown at X in Fig. 2, in all the punch-holders employed, interchangeability with the adapter is assured. The choice of an appropriate group of mounting holes to be drilled through each individual punch-holder will, of course, be dependent upon the size of the holder.

The diameter of holes *F* as drilled directly from the jig will be the same as the tap drill diameter of holes *B* in the adapter. It is therefore necessary to open them up to a clearance diameter. A countersink ground to an included angle of 20 degrees should be inserted from the under side of the punch-holder to form the clearance hole taper, as illustrated.

Special heat-treated mounting screws, such as the one shown at Y, are inserted in these holes and threaded into the adapter on the punch press ram. In this way, various sizes of punch-holders may be set up and taken down in minimum time.

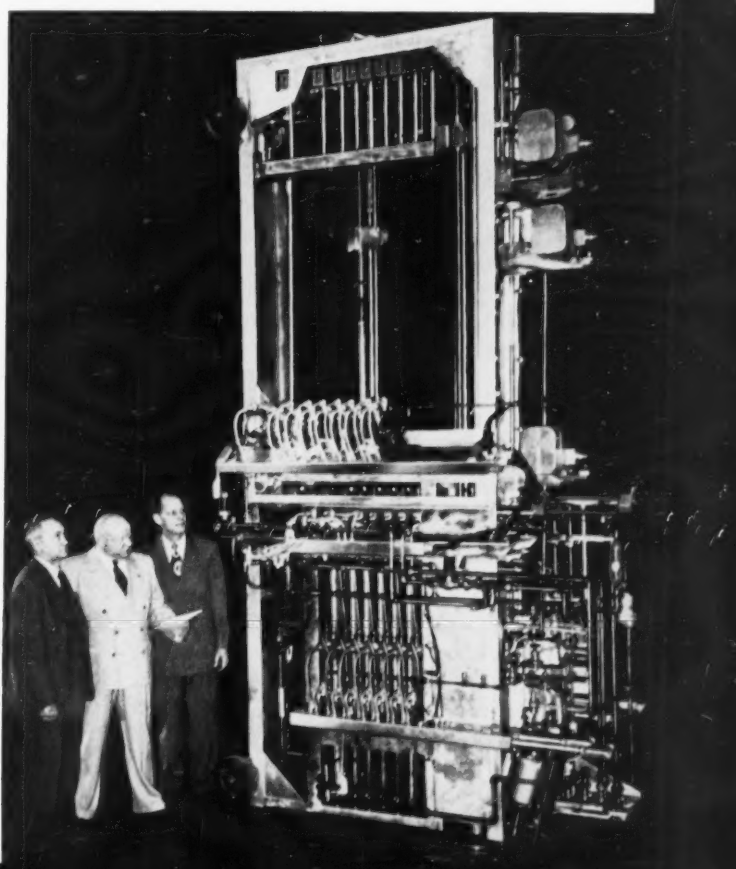
Machine Cleans and Checks Radioactive Rods

SUCCESS of the atomic submarine age will depend partly on two machines made by the John S. Barnes Corporation, Rockford, Ill. One of the machines, a hydraulic power unit that will be installed in a revolutionary type underwater craft, was described in December, 1953, MACHINERY, page 231. The second machine, shown in the accompanying illustration, will be used to clean and check the radioactive rods installed in a prototype of an atomic submarine engine built by the General Electric Co.

The 3000-pound rod cleaning and leak check machine was engineered by Dr. Joseph W. Phillips, a technical assistant of John S. Barnes Corporation. General Electric and Atomic Energy Commission engineers will install the machine in a service building next to a 225-foot steel sphere. Inside the sphere, scientists will build an atomic submarine engine, encase it in a section of submarine hull, submerge the hull in a water tank, and learn how to run the engine.

The machine will clean the radioactive heating rods, measure the amount of atomic energy left in them, and check their cases for leaks. Operation will be entirely remote controlled. A room 12 feet thick will surround the machine, and the machine itself will be in a glass case filled with helium gas under pressure. The purpose of the inert helium is to deter radiation.

Rods to be tested will be brought to the machine in radioactive-proof barrels. The machine will select the rods, hoist them out of the barrel, drop them into cleaning tubes, clean them with steam and water, inspect their shells for leaks, and measure the strength of their radioactivity. Then the machine will dispose of the rods through an exit tube.



Machine built by John S. Barnes Corporation for cleaning and checking radioactive rods. Standing next to the machine, from left to right: Dr. Joseph W. Phillips, designer; Ernest J. Svenson, president and general manager; and Al Marxman, one of the men who worked on the equipment

Automation Applied to Crankpin Grinding Machines

TRANSFER type crankpin grinding machines being built by the Norton Co., Worcester, Mass., will permit one of the first applications of automation to precision grinding operations. These machines have been designed to mechanize all the manual duties of the operator. They incorporate advanced equipment for accurately grinding the crankpins automatically.

When using these machines, the operator merely observes the operation while all the grinding and handling functions are accomplished automatically and continuously. As the crankshaft proceeds from one grinding station to the next, succeeding journals are ground until the shaft is finally deposited on a conveyor line completely ground. A single operator is required to supervise the complete unit, which has a grinding station for each crankpin to be ground.

In addition to the actual motions involved in loading, unloading, and grinding crankpins, an important feature of the machine is automatic truing of the grinding wheels at predetermined intervals—after each grind or any number of grinds, as may prove most economical. As the wheel is trued, there is an automatic compensation made in the wheel feed mechanism for the reduction in diameter of the grinding wheel.

An arrangement for automatically inspecting each crankpin after it is ground is available on the machines now being made. Inspection is accomplished while the crankshaft is being transferred between grinding stations. A system of lights controlled by the inspecting device warns the operator when the ground size of the shaft approaches either the high or low limit of the allowable tolerance. Adjustment of wheel position to insure grinding the crankshafts within dimensional limits is then made by the operator.

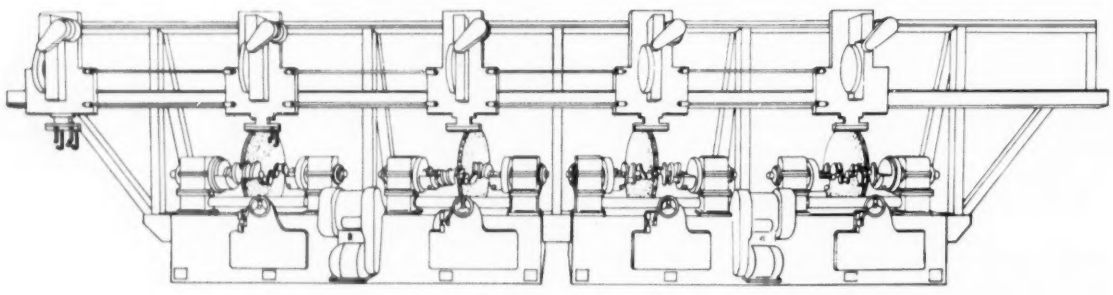
Norton's new machine is built in sections, as shown in the accompanying sketch, each base section supporting two grinding wheel heads and two pairs of work-heads which are driven by a single motor. Each wheel head carries a 42-inch diameter grinding wheel driven by its own motor. Wheel feed is operated hydraulically with rapid motion provided by a cylinder which moves the complete unit. Actual feed for grinding the body of the crankpin is accomplished by a large-diameter feed-screw which is revolved in its nut.

The transfer mechanism consists of an overhead track which extends the whole length of the unit from loading to unloading conveyor stations. Transfer heads travel vertically to pick up and deposit the crankshafts at each station and horizontally to transfer the work between stations, all heads moving in unison. Cranks in process are all picked up at the same time and moved one station to the right for either grinding of succeeding pins or placing in the conveyor station for transfer to the next operation. While the actual grinding is being done, the traveling heads return to the pick-up station.

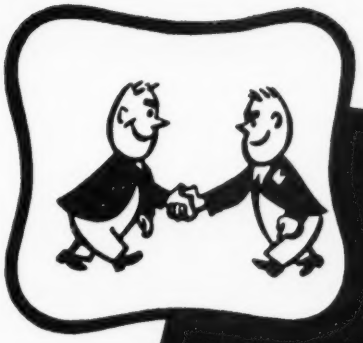
* * *

New Officers for American Society for Metals

The American Society for Metals recently nominated the following officers for the ensuing year: President, George A. Roberts, vice-president, technology, Vanadium-Alloys Steel Co., Latrobe, Pa.; and vice-president, A. O. Schaefer, vice-president in charge of engineering and manufacturing, Midvale Co., Nicetown, Pa.



Sketch of transfer type crankpin grinding machines being built to accurately grind crankpins automatically



The Sales Engineer and His Problems

By BERNARD LESTER
Management Consulting Engineer
New York

Making Full Use of Factory Specialists

IN last month's article having deplored complete reliance on various supports or props in selling, now let us consider their wise use. One real aid to the territorial sales engineer is the technical specialist assigned to help at the proper time and place. "You should write about the clever use of engineering specialists," one such man recently told me, "because I see many instances wherein a sales engineer can enlist my services to greater advantage."

Only the miracle sales engineer has an exhaustive technical knowledge relating to the design, production, performance, and application of the equipment he sells. The average sales engineer can be helped by a technical specialist, but derogatory comments like the following are often heard:

"This guy claims to be an expert. I'll just watch him perform—like as not he'll stub his toe."

"Just let me introduce him to this tough nut. If he's going to tag along on my calls, let him take the ball and I'll duck out and see someone else in the plant."

"This fellow just doesn't appreciate personality selling. I'm running the show. I'll make him be quiet—a bump on a log—except when I turn to him for an answer to a technical question."

"Let's see . . . I've got to watch out that this chap doesn't rush back to headquarters and tell them *he* got the order."

The sales engineer requires technical help to an increasing degree and should welcome the assistance of his own company specialists, men who are on the payroll for such specific purposes. He should realize that the specialist is a cooperative partner, not a competitive salesman. As such, he should be posted on the problems involved, and informed of the interests, influence, and business habits of the prospect.

In introducing the specialist, his importance and scope of knowledge should be emphasized, but not unduly. It is usually a mistake to introduce him as an expert in the particular business of the customer. If so, the prospect may think, "Well if he is so good, let's see if I can stump him." A good plan often is to let the knowledge of the specialist establish itself naturally in the course of the interview with a prospective customer.

The sales engineer should guide the progress of the interview at least to the point that the prospect and the specialist are nicely "mated" in a technical discussion. It is a mistake to withdraw and leave the prospect and specialist together before a happy relationship is established.

A vital part of any three-person interview is the conversation between the sales engineer and the specialist. Remarks between the two may go a long way toward selling the prospect. For instance, on occasion the sales engineer might say to the specialist, "We must not forget these people build a quality product." Or, "This job requires close individual attention, because delivery is so important." Or, "Will your recommendation interfere in any way with continuity of operation? This plant has a wonderful reputation for smooth mass production."

It is a mistake for a sales engineer to call in an engineering specialist only when the customer has a difficult problem. The expert does not then have the opportunity of creating an image in the prospect's mind that he is capable of giving valuable advice concerning manufacturing processes, as well as being a trouble shooter called on when things go wrong.

The responsible specialist who understands his company's policies may well form close friendships with customer personnel. He can greatly strengthen the position of the sales engineer in the latter's territory.

LATEST DEVELOPMENTS IN *Shop*

Acme-Gridley Single-Spindle Automatic Chucking Machine

Completely automatic control of the entire machining cycle and adaptability for incorporation in an automation production line are outstanding features of a 12-inch universal single-spindle automatic chucking machine recently announced by the National Acme Co., Cleveland, Ohio. This Model MC Acme-Gridley automatic is designed to offer exceptional versatility for tooling, so that more operations can be performed automatically without rehandling the work-piece. In addition to regular drilling, turning, and forming operations on the seven independently cam-actuated tool-slides, provision is made for the use of specialized attachments, including self-opening dies and collapsible taps.

This adaptability, in addition to the automatically selective speed and feed ranges, permits the use of balanced tooling for high production on chucking work that must be held to close tolerances and have a fine finish. A variety of jobs have been handled on the new

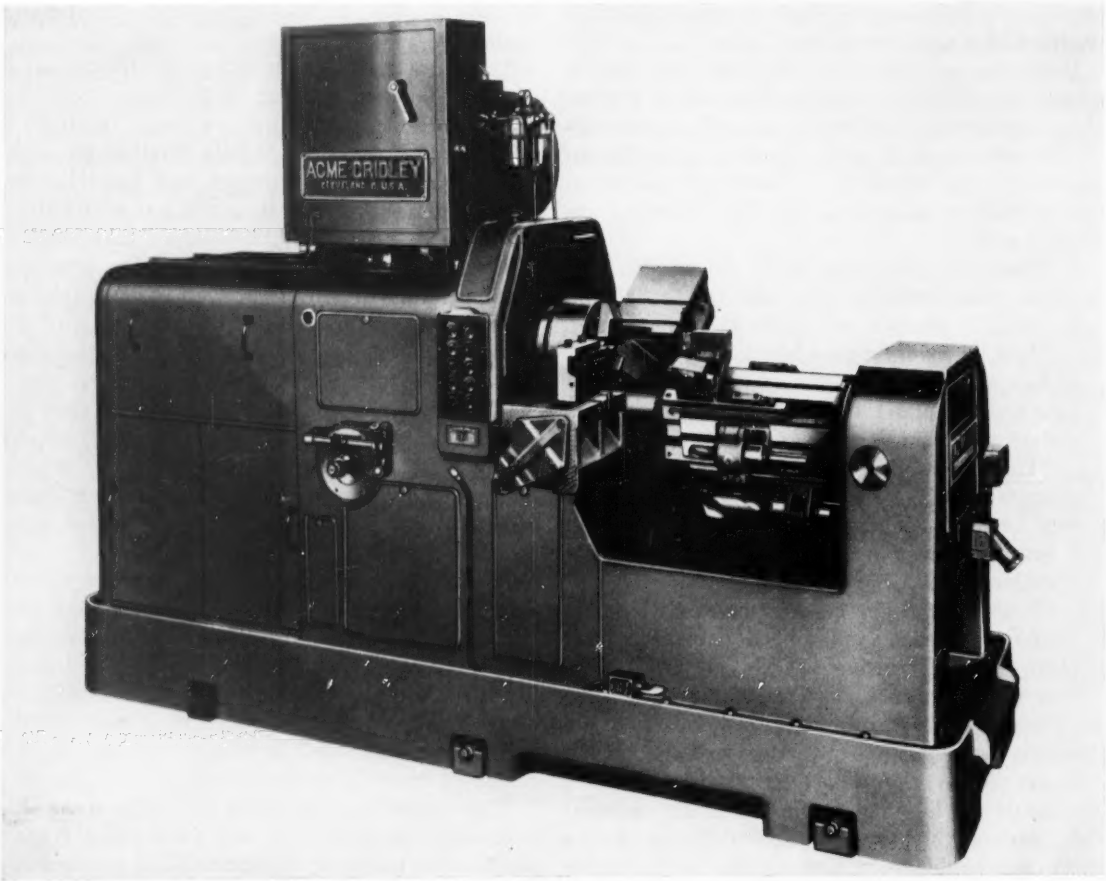


Fig. 1. Acme-Gridley universal single-spindle automatic chucking machine

Equipment

Machine tools, unit mechanisms, machine parts, and material-handling appliances recently placed on market

Edited by FREEMAN C. DUSTON

machine at floor-to-floor production speeds five times faster than attained by methods previously employed. There is no time loss from the start of the machining sequence which follows loading until the finished piece is unloaded. This results in less operator fatigue, maintenance of the same machine cycle rate at the end of a shift as at the start, and more accurately scheduled production. The open tooling zone and easily accessible chucking area provide adequate space for the installation of automatic work-loading and handling equipment.

Wider speed and feed ranges, with speed changes automatically controlled during the machine cycle, give this chucking machine greater versatility in combining carbide and high-speed steel tooling, including threading equipment, in the same automatic setup. The five turret tool-slides and the two cross-slides each have independent cams. "Idle time" movements, such as that of advancing tool-slides to the cutting position and indexing the turret-slides, are all accelerated. The total machining time for each piece is predetermined in accordance with the tolerances and finish required.

The machine is designed to facilitate tooling up, since the tooling zone is without interference from shafts or accessories and the operator has free access to the tools at elbow height. Cams for the tool-slides are readily accessible, and the timing control switches are grouped for operation from cam dogs mounted on a single drum at the rear of the machine. This design for quick change-over from job to job makes the air-operated system economical and practicable for small-lot set-ups as well as long production runs.

The mechanism for automatically controlling the work cycle is shown in Fig. 2. All operating functions during the machining cycle are controlled automatically and synchronized with the main drum shaft. National Acme Supersensitive switches, operated from the main drum shaft, provide automatic control to change spindle speed and feed ranges as required, also to shift the drum shaft speeds so that tool-slide movements (except during cutting travel) are performed at high speed, and to stop the machine at the end of a tooling cycle.

Turret indexing is controlled by Snap-Lock switches and requires one second between positions. Side- and end-working tool-slide operations may be overlapped without delaying the turret index.

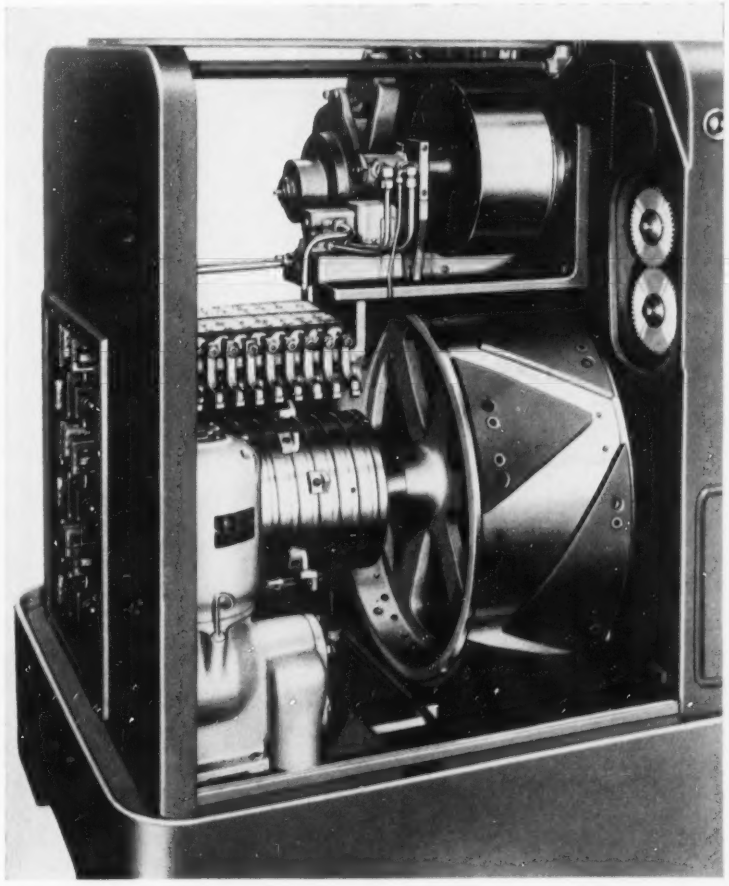


Fig. 2. Mechanism for automatically controlling work cycle of the Acme-Gridley automatic

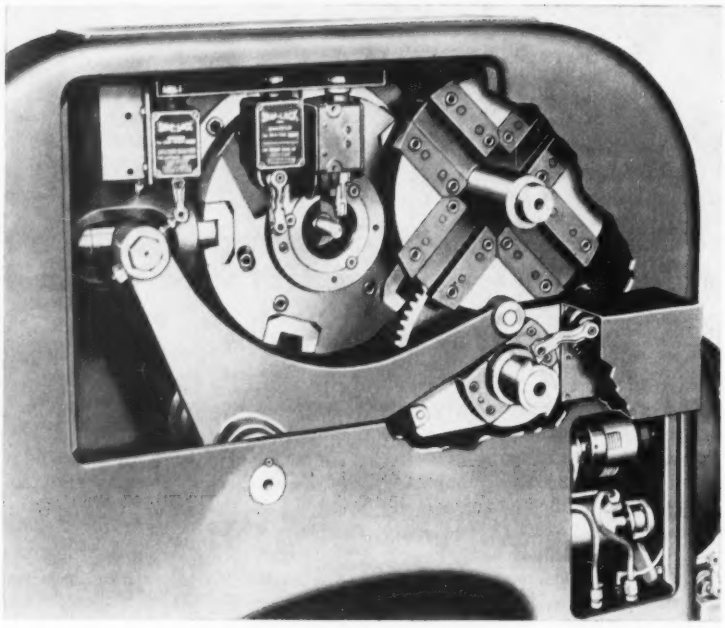


Fig. 3. Turret indexing mechanism and safety controls of chucking machine

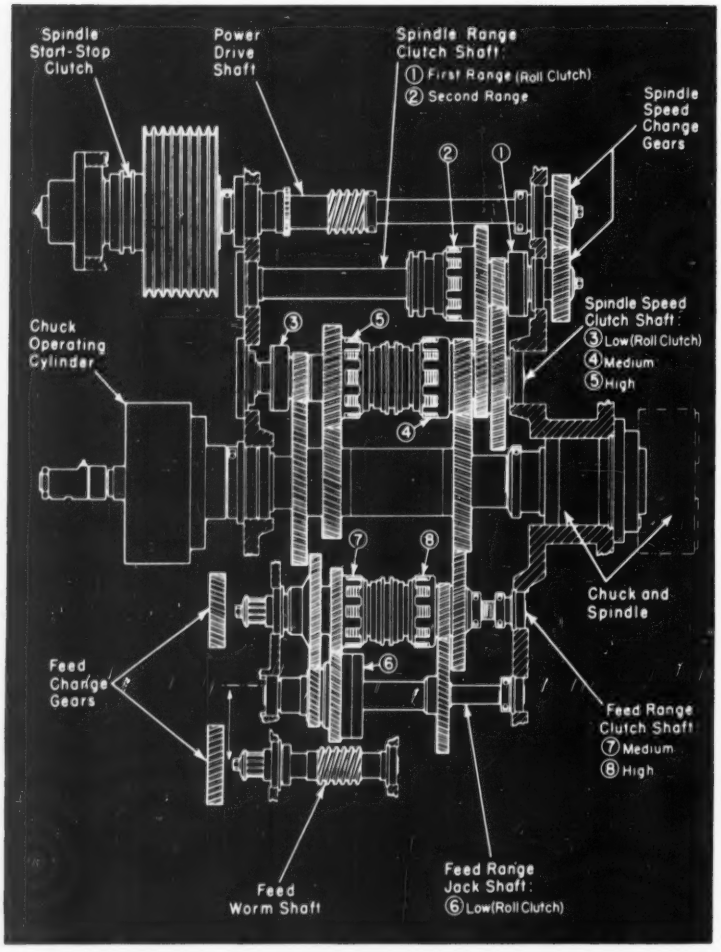


Fig. 4. Drive to work-spindle and main drum shaft of machine illustrated in Fig. 1

This affords substantial production gains. Independent cams for each tool-slide, together with automatically selective spindle speeds and feeds, permit synchronizing all slide movements to obtain speeds and feeds best suited for each operation.

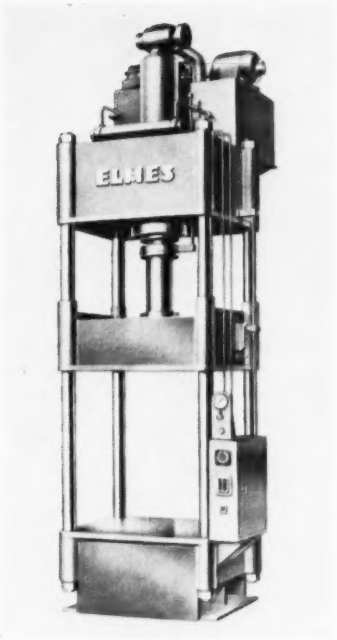
Safety controls, shown in Fig. 3, prevent turret indexing until the turret tool-slide is completely returned. With this independently controlled index mechanism, it is practical to "skip index" through one or more turret-slide positions. Also, short operations performed on the end can be overlapped with long forming cuts.

The drive to the work-spindle and main drum shaft is shown in Fig. 4. Two clutch shafts that drive the work-spindle provide two ranges of three speeds each with one set of change-gears—six different automatically selective spindle speeds in each of seventeen standard ranges.

The main drum-shaft drive affords three automatic feed ranges with each set of change-gears. Driven from the work-spindle, this gearing insures tool-slide feeds in proper relation to the work-spindle speed. With a few cams of different angles and the selectivity of the feed change-gears, only minimum changes are required for any range of similar work. A spindle start-stop clutch provides automatic stopping at completion of the machine cycle. Feeds are inoperative unless the spindle is rotating. Lubrication of shafts, gears, and bearings is automatic and continuous. Grease fittings are provided for slides and other parts not served by the automatic system.

The machine has a maximum swing of 13 inches, and a turning and boring length capacity of 8 inches. The front and rear cross-slides have a maximum travel of 4 1/2 inches. Power is furnished by a 25-H.P., 1800-R.P.M. motor. The lowest automatic range of six speeds is from 25 to 360 R.P.M., and the highest from 102 to 1478 R.P.M. Turret-slides have a feed range of from 0.0037 to 0.0448 inch. Cross-slides have a feed range of from 0.0007 to 0.0084 inch. The net weight of the machine, including motor, chip conveyor, and standard parts, is 15,700 pounds. 101

For more information on these products, use Inquiry Card, page 265



Elmes press which is designed for plastics molding

Elmes Hydraulic Press for Reinforced Plastics Molding

A line of hydraulic presses specifically built for fiber-glass molding has been announced by the American Steel Foundries, Elmes Engineering Division, Cincinnati, Ohio. These presses are made in standard capacities ranging from 50 to 300 tons, and larger tonnage presses can be designed and built to suit individual requirements.

The main ram capacity of the particular press illustrated is 100 tons and the stripping capacity, 30 tons. This press has an operating pressure of 2460 pounds per square inch and a 36-inch stroke. It accommodates dies up to 48 inches from left to right and 36 inches from front to back. The press is push-button controlled. Operation is at an advance speed of 400 inches per minute, and at a predetermined adjustable position automatically slows down to the desired pressing speed. The pressing speed is adjustable downward from 16 inches per minute to practically no movement.

An adjustable timer is provided which can be pre-set for any length of cure cycle desired. When the cure time has run out, the press will automatically open the mold at a predetermined breakaway speed. After the mold has moved away from the work a predetermined distance, the press returns to the up-stop position at the rate of 400 inches per minute. This position can be adjusted by changing the position of the up-stop limit switch. Thus it is not necessary to have the ram return to its top position. Any portion of this stroke can be utilized by adjusting the return limit switch. A 7 1 2-H.P., 1200-R.P.M. motor supplies power. 102

Springfield Vertical Universal Grinder

A 42-inch vertical universal grinder, with a normal maximum swing of 52 inches, has been brought out by the Springfield Machine Tool Co., Springfield, Ohio. This machine is completely hydraulic and is designed for the precision grinding of large parts. It performs both external and internal cylindrical and taper grinding operations. Surface grinding work can also be done. Thus, multiple operation is possible with one chucking, making this 3-TR machine especially adapted for such work as finishing pipe-line valve plugs, jet-engine parts, molds, and other large items which must be extremely accurate with respect to size and concentricity.

This rugged machine can be used to grind tapered or straight holes as deep as 2 feet. With the same setting of the head used to grind a tapered hole, it will grind matching tapered parts to accurately fit the tapered hole. The head can be set at any angle up to 45 degrees.

The two matching parts of a mold for washing machine agitators, shown in Figs. 2 and 3, are

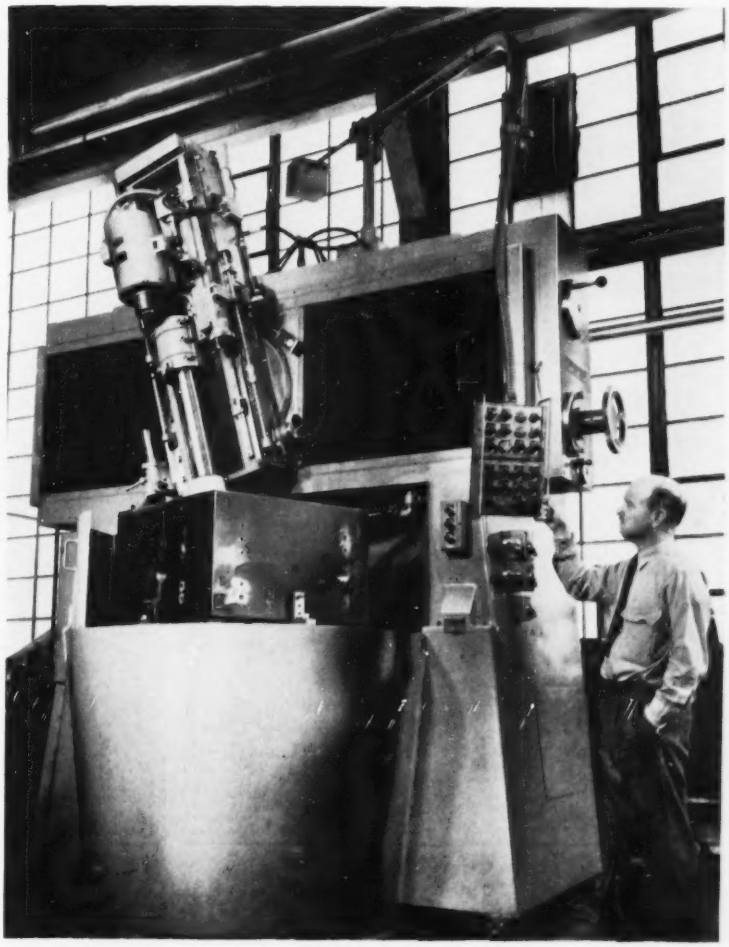


Fig. 1. Springfield vertical universal grinder with coolant splash guards removed to show work.

finished with one setting in four and one-half hours, floor-to-floor time. The recessed part of the mold, seen in Fig. 3, consisting of a square block of steel 43 inches across corners, had been rough-bored on a vertical turret lathe. It was then hoisted onto the 42-inch grinder faceplate, secured with four clamps, ground, and hoisted off again. The hole was 20 inches deep, 20 inches in diameter at the top, and had a 15-degree taper.

The matching truncated cone-shaped part, Fig. 2, was quickly positioned on the grinder, secured with a long bolt through the center, and then quickly finished. In this case, the Springfield grinder removed 0.015 inch of stock on a side. In machining these mold parts, the operator merely has to direct the hoisting, fasten the work, set the head angle, aim the coolant tubes, and then actuate the push-buttons in the pendent station, which contains all the operating controls.

This 42-inch machine—an addition to the company's 16- and 25-inch vertical universal grinders—can also be furnished with a cross-rail, which can be adjusted from 12 to 48 inches above the faceplate. The machine is regularly furnished with one head, but can be provided with a number of heads and side-heads.

The grinder has work-spindle speed ranges of up to either 88 or 176 R.P.M. in either direction. The grinding head has a stroke of 27 1/2 inches, with speeds of up to 185 inches per minute. The maximum clearance over the faceplate is 25 inches, and over the work-spindle, 30 3/4 inches. The rapid traverse has speeds of up to 100 inches per minute. The 10-H.P. wheel-spindle motor speed is 3600 R.P.M. and the 7 1/2-H.P. hydraulic system motor has a speed of 1200 R.P.M. 103

Morey Billet Scalping Machine

A billet scalping machine has been developed by the Morey Machinery Co., Inc., New York City, for the turning of magnesium billets in sizes from 10 to 19 inches, and in lengths from 25 to 40 inches. The machine is equipped with a 200-H.P. motor, is hydraulically operated, fully automatic, and equipped with a loading device.

The billet, delivered to the machine on a conveyor belt, is picked up by the loading device and automatically placed on loading jacks in the machine. The quill presses the billet against the headstock. The billet has no centers, and is held only by the pressure exerted by the quill and driven by buttons which make a maximum impression of about 1/32 inch in the billets. A carriage, which can be equipped with eighteen tools, is

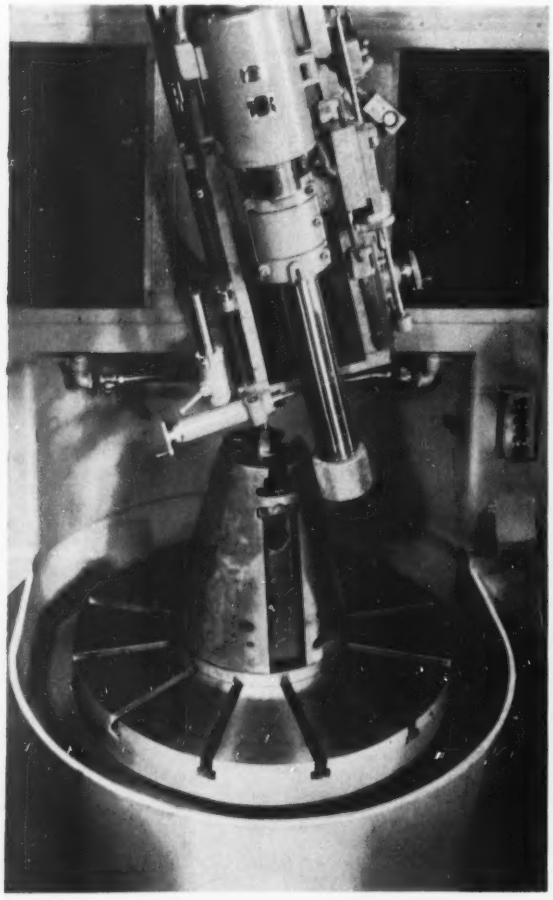


Fig. 2. Tapered part of a mold for plastic washing machine agitator shown in position on faceplate of Springfield vertical universal grinder

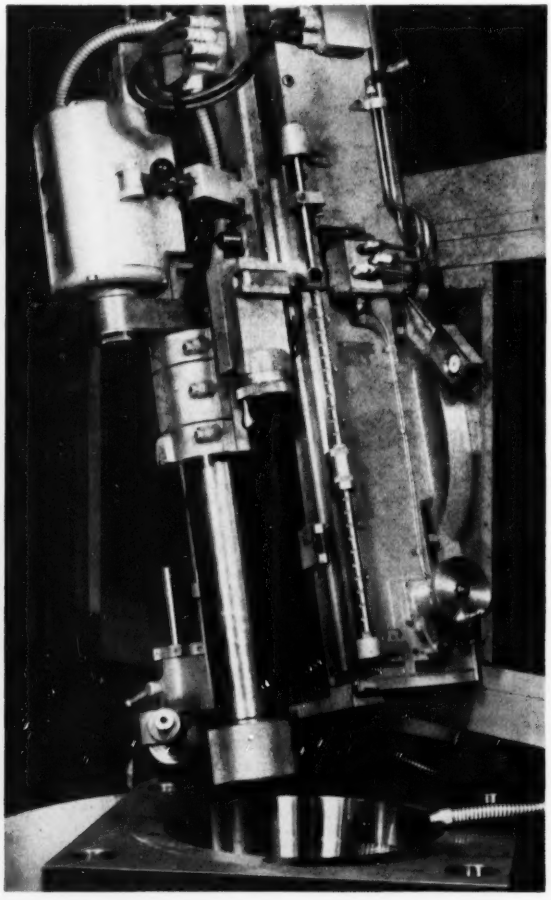
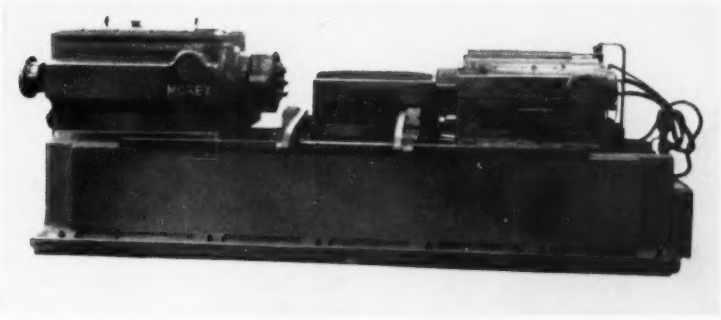


Fig. 3. Matching part of mold illustrated in Fig. 2 after grinding on 15-degree taper. Same angle setting of head was used for grinding both mold parts.

For more information on these products, use Inquiry Card, page 265



Billet scalping machine developed by the Morey Machinery Co., Inc.

hydraulically actuated and operated in an automatic cycle.

The finished billet is picked up by the loading device and deposited on the conveyor, and the next billet is loaded into the machine. The cycle is completely automatic. However, the operator can stop the machine at any time, and each cycle of the complete operation can be actuated individually. The machine turns billets 19 1/4 inches in diameter by 40 1/2 inches long to a diameter of 17 5/8 inches at the rate of thirty billets an hour. 104

Landis Centerless Grinder

A centerless grinder, designated the No. 12 1/2 model, has been developed by the Landis Tool Co., Waynesboro, Pa. This heavy-duty machine is designed to grind parts to extremely close tolerances on a high-production basis and incorporates features that help make automation both practical and economical. Automatic loaders and automatic cycles can be used for the production of parts by either the in-feed or through-feed method. A variation of the in-feed method, known as end-feed grinding, is used for taper grinding.

Quick, easy set-ups facilitate the efficient handling of small-lot production. Work-pieces up to a diameter of 6 inches can be ground on this model, which uses grinding wheels with a maximum diameter of 10 inches. Available extra equipment and tooling include hand and automatic work loaders, automatic dressing tools, heavy-duty work-rests, and sizing gages. Automatic cycle and hydraulic grinding feed are also available features.

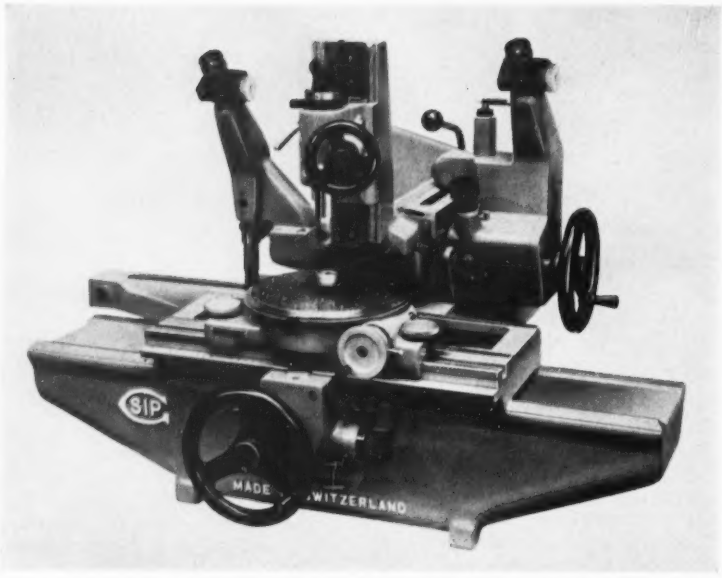
Another outstanding feature of the machine is pressure lubrication for the grinding wheel spindle bearings. This system floods the bearings with filtered lubricating oil from a separate reservoir. It has its own pump and safety pressure switch and requires pressure to be built up in the circuit before the wheel-drive motor will start. If the pressure should fail, the drive motor will stop.

Two methods of dressing the regulating wheel are available, one dressing the wheel on the line of work contact by hydraulically moving the wheel-head past a diamond mounted on the work-rest. For users who prefer an overhead dresser, there is a hand-operated dresser that permits compensation for wheel tilt. A hydraulically operated dresser is also available for the regulating wheel-head.

An unusual feature of this Landis centerless grinder is the arrangement of the machine elements. The grinding wheel is at the right-hand side of the machine and the regulating wheel is on the left-hand side of the bed. The work-rest is mounted directly on the bed casting between the two wheels. Both wheel-heads slide on ways and the work-rest is positioned rigidly between the wheels. The regulating wheel-head may be tilted for through-feed grinding or swiveled for taper grinding.

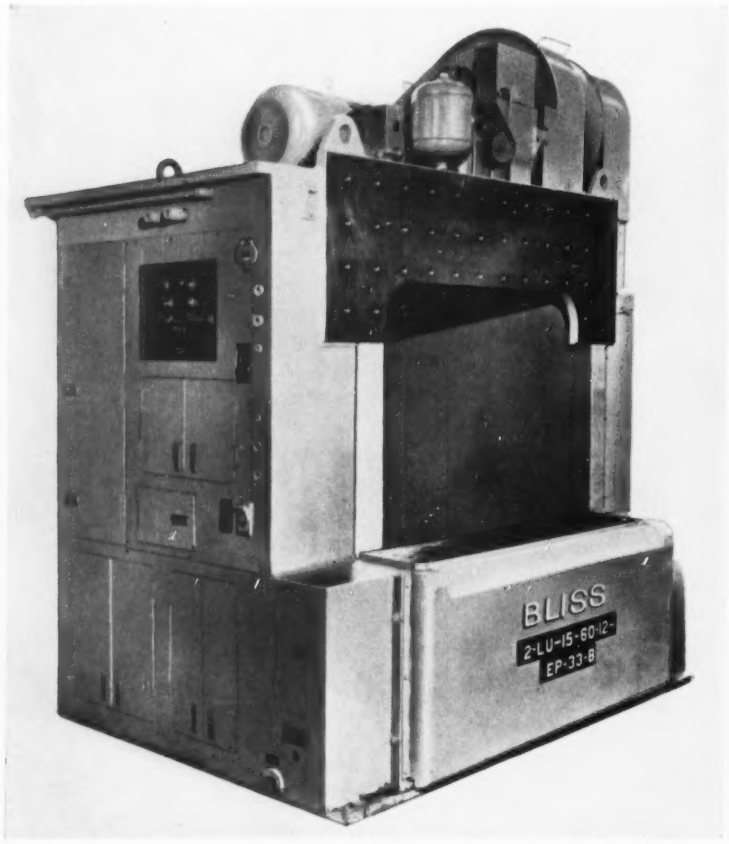
The standard through-feed or in-feed work-rests will take work from 1/2 inch to 3 1/2 inches in diameter. Heavy-duty through-feed or in-feed will handle work from 3 to 6 inches in diameter. Standard grinding and regulating wheel widths are 4, 6, 8, and 10 inches. The grinding wheel diam-

Landis plain centerless grinding machine with through-feed work-rest



Universal measuring machine introduced by American Sip Corporation

eter is 24 inches and the regulating wheel diameter, 14 inches. The speed of the regulating wheel can be varied from 12 to 100 R.P.M., and the dressing speed is 300 R.P.M. The grinding wheel is driven by a 20- to 25-H.P. motor and the regulating wheel is powered by a 1-H.P. motor. The weight is 12,900 pounds. 105



Bliss welding press with built-in piping, controls, and wiring

Sip Measuring Machine

A Sip universal measuring machine equipped with standard scales is being introduced in this country by the American Sip Corporation, New York City. Micrometer microscopes of new design permit readings to 0.00005 inch to be made within the field of the eyepiece with maximum ease and clearness. Another feature of this Model MU-214B machine is the provision for taking linear measurements according to a system of three rectangular coordinates. Angular readings can also be taken conveniently by means of a goniometric microscope. A precision rotary table provides for measurements in polar coordinates. A variety of accessories permits the measuring machine to be adapted for a wide range of inspection work. 106

Welding Presses with Built-In Piping, Controls, and Wiring

The E. W. Bliss Co., Canton, Ohio, has announced a new welding press with all piping, controls, and wiring located inside a streamlined frame. This arrangement is designed to afford greater protection for the operating controls and at the same time maintain accessibility. The machine also has the advantage of being ready for operation as soon as installed. It is available in four sizes with underdrive and conventional drive arrangements for use in high-speed, automatic assembling of large metal sections. Beds are 12 inches deep, with widths ranging from 42 to 84 inches. Strokes are 8 and 10 or 8 and 12 inches.

The welding press is available in two models. The 4LU series, for use in shops with limited headroom, have the driving unit in the base. Where headroom is not a consideration, the 4L series with the driving mechanism on top of the press can be used. In the latter series, the stroke can be altered without changing any parts. The lower die, which is supported at four points to assure accurate positioning, moves up to contact a stationary upper die.

These welding presses can be

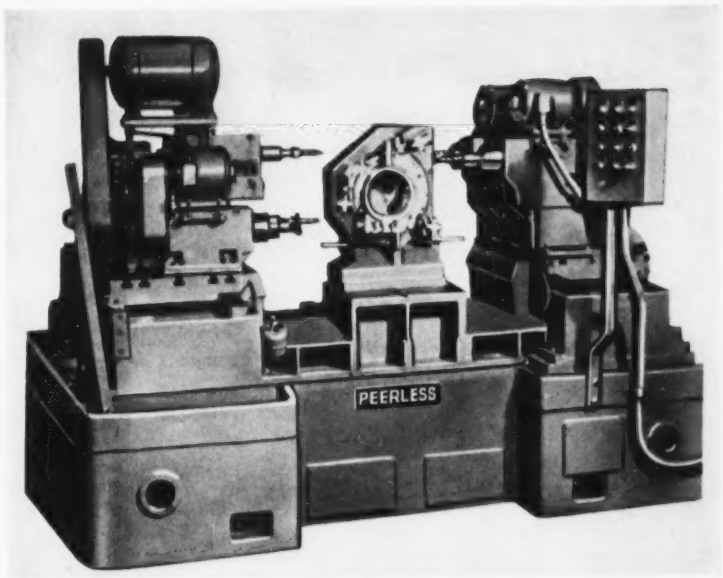
For more information on these products, use Inquiry Card, page 265

built to accommodate practically any size section. The 4L press has a clear die space 72 by 38 inches, a shut height of 44 inches, and an over-all height of 126 inches. The 4LU press has a clear die space 69 by 29 inches, a shut height of 30 inches, and an over-all height of 94 inches..... 107

Peerless Double-End Boring Machine

A double-end precision boring machine with hydraulically actuated cross-slide was recently delivered to an automobile company by the Peerless Production Co., Detroit, Mich. To assure precision operation of this equipment, a power-operated mechanical take-off device is provided which clamps the slide in position during the machining cycle. This device permits the boring of accurately and closely spaced holes in a single set-up.

This specialized machine performs boring, chamfering, and trepanning operations to precise specifications on pump housing assemblies. It trepans one groove 0.062 to 0.072 inch wide by 0.049 to 0.054 inch deep; taper-bores a hole with a taper of 0.250 inch per foot; bores holes 0.437 to 0.436 inch and 1.1255 to 1.1250 inches in diameter, and another hole 2.410 to 2.408 inches in diameter; then performs a 0.060-inch 30-degree chamfering operation before finishing the work with a reaming operation. The pump housing assemblies are processed at the rate of thirty per hour. 108

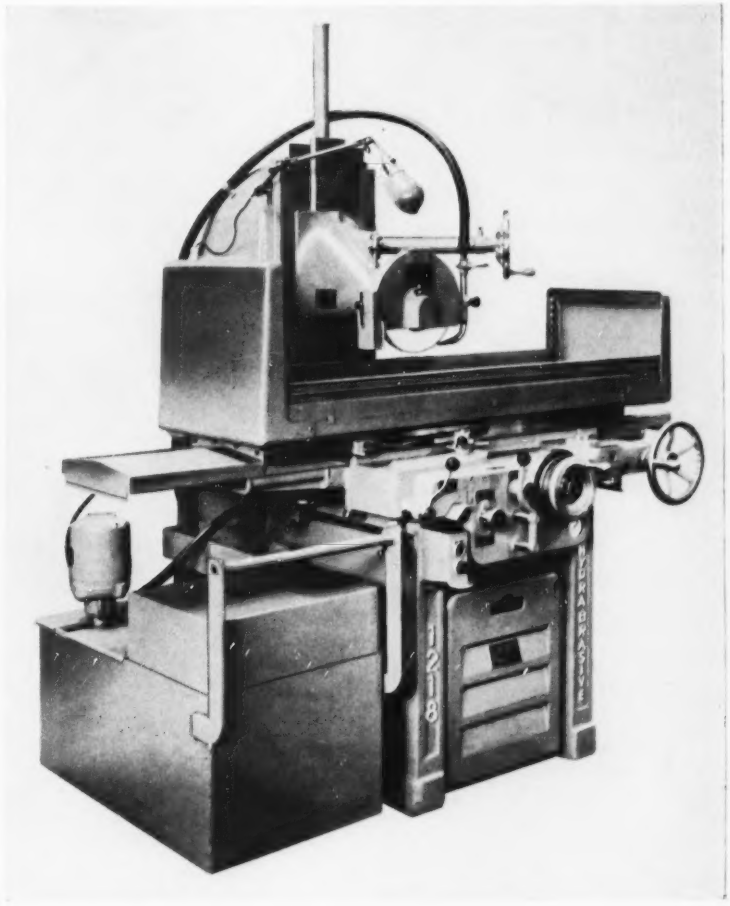


Peerless double-end precision boring machine for processing pump housings

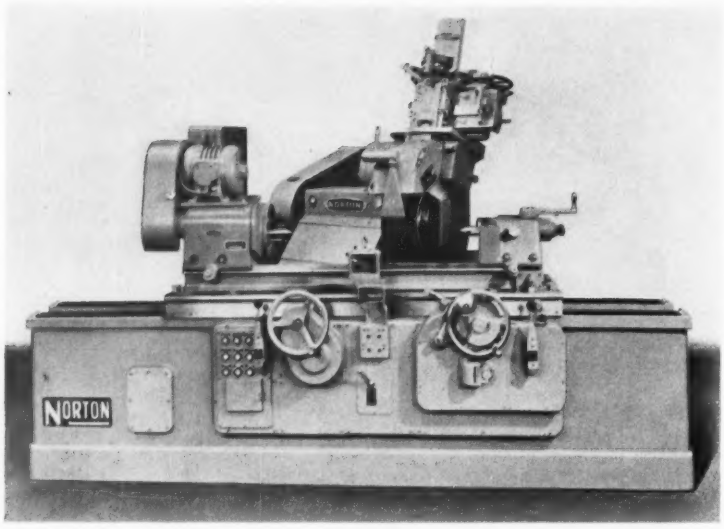
"Hydrabrasive" Surface Grinder

The Abrasive Machine Tool Co., East Providence, R. I., has equipped its 1218 "Hydrabrasive" surface grinder with a cross-feed backlash eliminator. This special feature permits precision transverse adjustments to be made with freedom from errors due to backlash.

The backlash eliminator works in combination with the saddle ball-mounted ways to make sure that a movement of 0.0001 inch on the cross-feed dial produces a saddle movement of 0.0001 inch, regardless of which direction the adjustment is made. The cross-feed handwheel is equipped with a large-diameter barrel and easy-to-read vernier for quick, accurate adjustments with minimum danger of reading errors. ... 109



"Hydrabrasive" surface grinder with backlash eliminator



Semi-automatic angular wheel-slide grinding machine built by the Norton Co.

Norton Semi-Automatic Angular Wheel-Slide Grinding Machine

The Norton Company, Worcester, Mass., has announced a Type CV-4 semi-automatic angular wheel-slide grinding machine, which will replace its Type C angular machine. The new machine is designed to rapidly grind thrust surfaces and adjacent diameters simultaneously in a single, automatically controlled, plunge-grind operation, thus eliminating the separate operation normally required.

Faster sizing and simplified operation are other advantages claimed for the machine. Rapid accurate sizing is made possible by the Norton CTU type wheel-feed mechanism with its hydraulically rotated, micrometer-screw feed. This mechanism also includes a "click-count" index with which settings for work diameter reduction in increments as fine as 0.0001 inch are made instantly.

Settings for both the length and rate of automatic feed are made quickly from the normal operating position. The handwheel that adjusts the grinding wheel feed is located on the machine base at the operator's right hand instead of on the movable wheel-slide, as on the earlier machine. This graduated wheel continually indicates the amount of feed as it rotates past a fixed pointer.

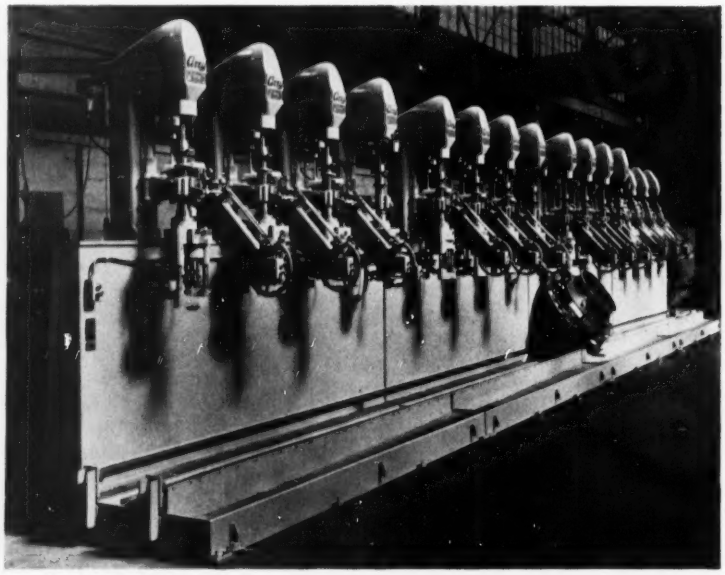
Normal operation of the machine requires three simple actions: loading the work; touching a one-lever control which starts the automatic grinding cycle, work rotation, and coolant flow; and removing the work at the automatic, electrically controlled termination of the grind. Further simplification is obtained with the automatic wheel-guard type truing device which quickly trues wheels to the required form when a push-button is pressed. It also gives close, uniform control of the amount of abrasive removed from the wheel, reducing wheel cost per work-piece ground. Although wheel wear compensation is not an integral feature of the machine, it is available as extra built-in equipment. The machine takes heavy work loads and performs roughing or the finest finishing operations with equal facility. It will use grinding wheels having face widths up to 8 inches. The base ways are protected by steel tape guards. Electrical and hydraulic equipment conform to J.I.C. Standards.

The Type CV-4 machine is available in 10- and 14-inch swings, and in 36-, 48-, or 72-inch work lengths. 110

Avey In-Line Transfer Machine for Processing Jet-Engine Parts

An in-line transfer machine 62 feet long, consisting of sixteen standard power feed Avey drilling units, has been built by the Avey Drilling Machine Co., Inc., Cincinnati, Ohio, for use in the production of jet engines. Each drilling unit is equipped with a multiple-spindle drill head for performing drilling, countersinking, reaming, and lead-screw tapping operations on the stainless-steel jet-engine components.

Beneath the drilling units is positioned one transfer type fixture which moves longitudinally and radially. Each drilling unit is provided with four feeds, an adjustable head, and quill travel. The units can also be furnished with variable feeds. 111



Avey in-line transfer machine for processing jet-engine components

For more information on these products, use Inquiry Card, page 265

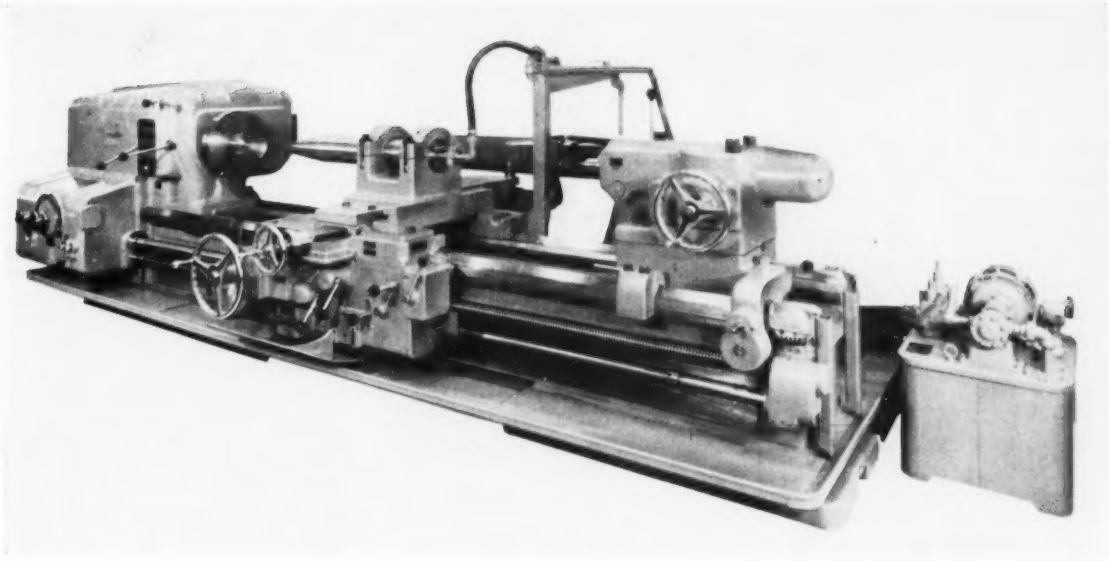


Fig. 1. Pacemaker lathe equipped for contour boring has been introduced by American Tool Works Co.

Tracer-Controlled Combination Contour Boring and Turning Lathe

The American Tool Works Co., Cincinnati, Ohio, has introduced a combination lathe for boring and turning work-pieces having irregular contours as deep as 8 inches on a side. The machine is basically a 25-inch, 50-H.P. Pacemaker lathe of this company's manufacture which has been equipped with a hydraulically actuated cross-slide. The movements of the cross-slide are controlled by the flat template, causing the cutting tool to reproduce the template shape on the work.

Interchangeable boring and turning rests provide for rapid change-over from boring to turning, and vice versa. The boring rest, seen in Fig. 1, forms a substantial mounting for the boring-bar and has an auxiliary bearing support across the right-hand carriage wings. Cutting coolant is carried to the tool through the center of the boring-bar, which has an outside diameter of 6 inches.

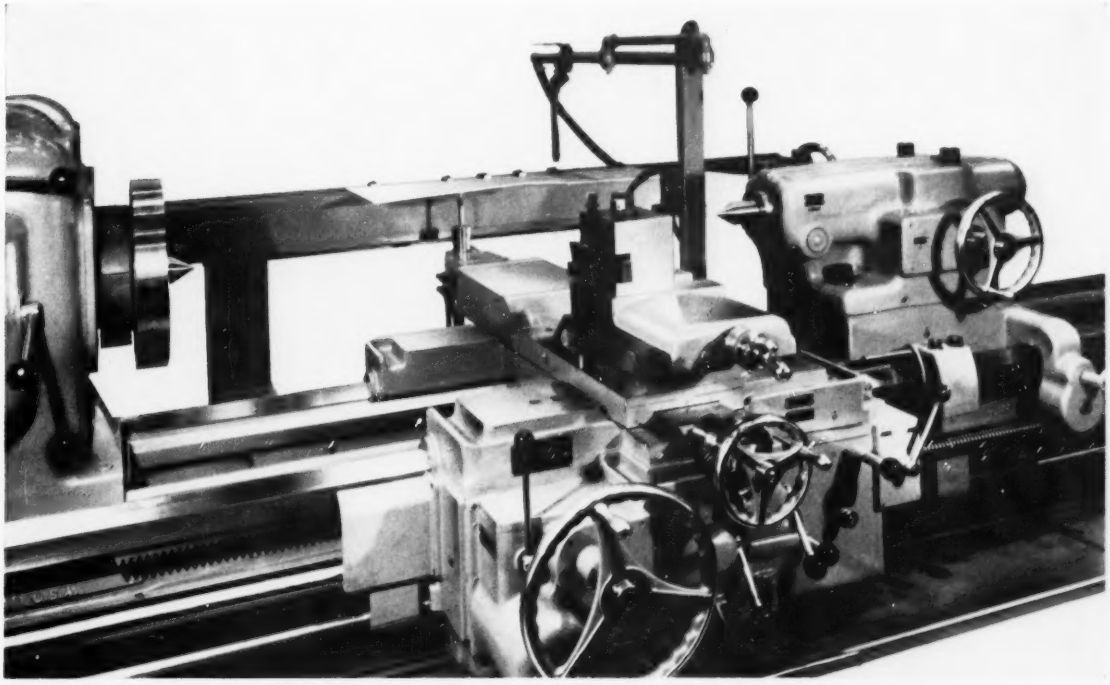
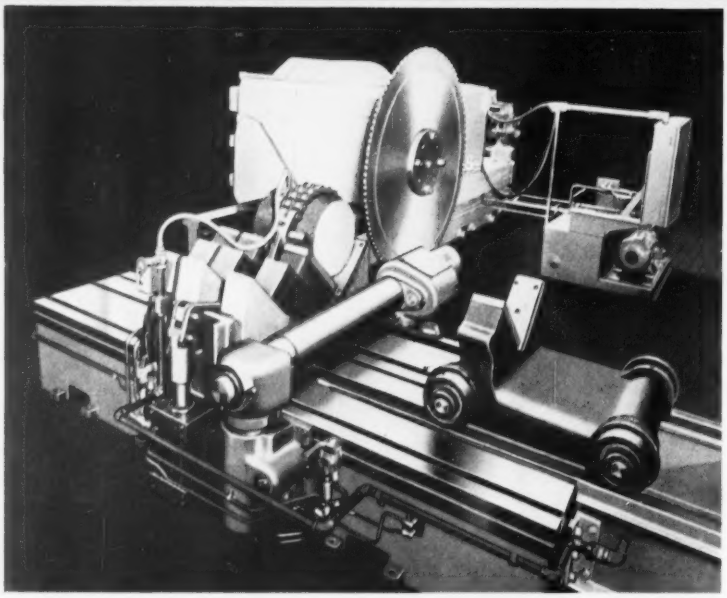


Fig. 2. Lathe shown in Fig. 1, with boring-bar rest replaced by compound rest for contour turning



Large circular sawing machine made by Motch & Merryweather Machinery Co.

The machine shown in Fig. 2 is arranged for contour turning operations. The boring-bar rest has been replaced by a compound rest provided with a heavy-duty double-screw tool-holder. This view shows clearly the flat work template in contact with the stylus that actuates the tracer valve. Hydraulic fluid at a pressure of 300 pounds per square inch is admitted to the operating cylinder under control of the tracer valve. The cylinder reacts against the piston which controls the movement of the cross-slide and its tool-rest. This combination contour boring and turning lathe is said to be particularly adapted for use in machining the intricate contours of jet-engine and guided missile parts. 112

High-Speed All-Steel Press Brake

An all-steel press brake is being manufactured by the Cincinnati Shaper Co., Cincinnati, Ohio, which can be used for high-speed punching and automatic feeding applications. This press brake operates at seventy strokes per minute and is equipped with a specially arranged ram. It is of rolled plate construction with an interlocked frame, push-button control for the ram adjustment, micrometer indicators on both ends of the machine, center-line loading, weld-free joints, and automatic pressure lubrication.

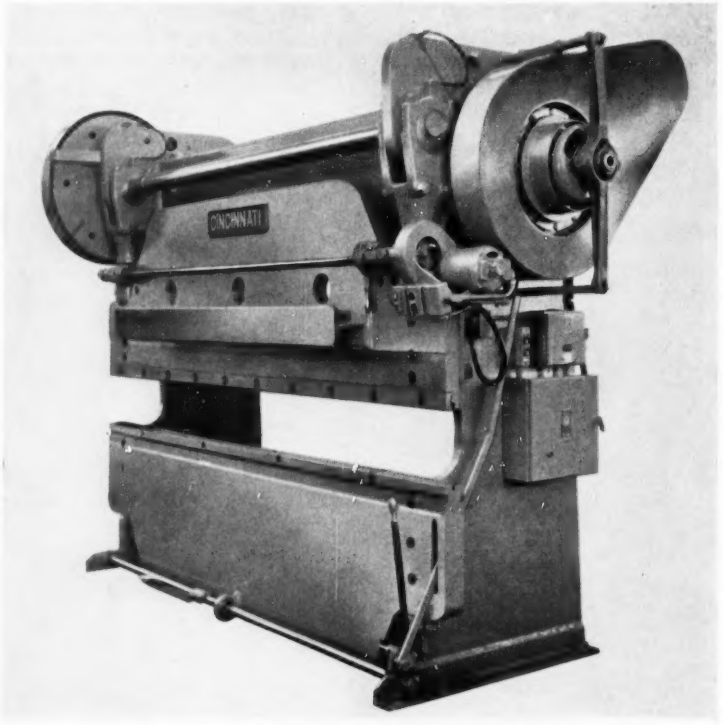
A double hook tongue is planed in the ram, and the bed member is doweled to the housings to withstand a stripping load of approximately 20 tons. 113

Motch & Merryweather Circular Sawing Machine

The Motch & Merryweather Machinery Co., Cleveland, Ohio, has extended its line of circular sawing machines by adding a larger model, the No. 5, which will cut off ferrous or non-ferrous stock up to 43 inches in diameter. The low-speed type machine seen in the illustration has the saw carriage mounted on a heavy base located at right angles to a heavy T-slotted work-supporting table. The saw carriage is of the single-speed type. Additional feed variations can be obtained by changing sheaves or gears.

The saw head is powered by a 30-H.P., 900-R.P.M. motor connected by multiple belts and sheaves to the gear train. The final spindle drive has large, heavy-duty, herringbone gears. The face of the spindle is 20 inches in diameter and has four pins for driving the saw blade.

Stock to be cut is placed in the V-block at the front of the machine. Clamping is by means of a hydraulic cylinder connected through linkage to a heavy roller chain. Larger diameters are accommodated by removing jaw sections of the V-blocks. A large elevating roller assists in raising the stock from the V-block and moving it forward. Power is applied by a gear-head motor. The roller is elevated by two hydraulic cylinders interconnected through the work-holding base. All movements, including the head feed and feed control, are hydraulically actuated, the power being provided by a hydraulic pump driven by a 5-H.P., 1200-R.P.M. motor, using a floor-mounted tank. . 114



Cincinnati high-speed all-steel press brake

For more information on these products, use Inquiry Card, page 265

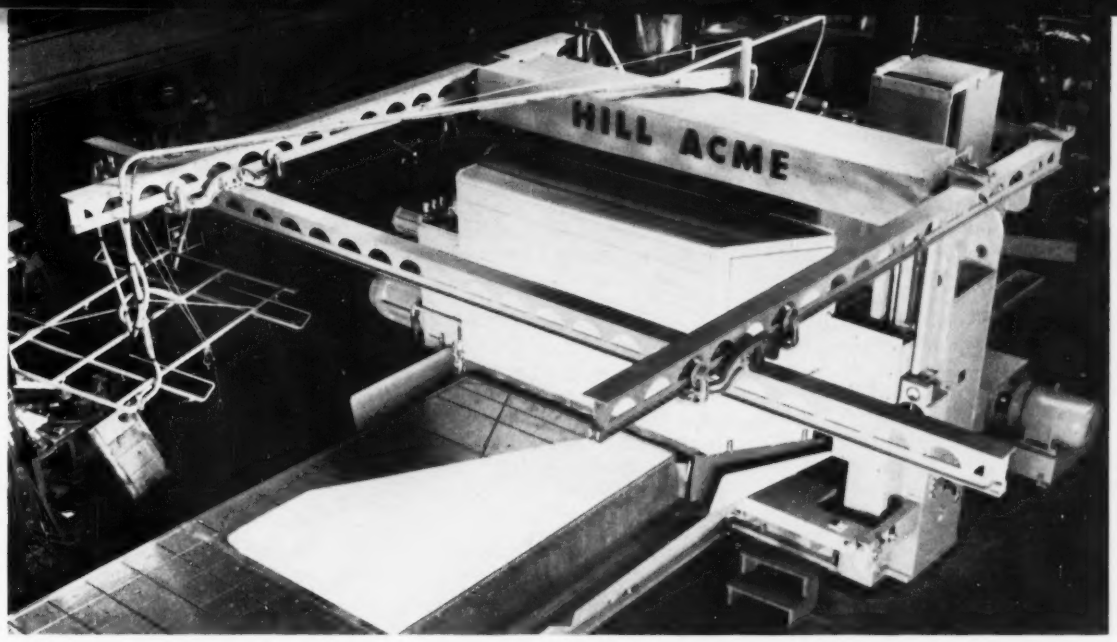


Fig. 1. Huge double housing abrasive belt grinding machine brought out by the Hill Acme Co.

Hill Acme Huge Abrasive-Belt Grinder for Aircraft Work

A giant-size double-housing abrasive-belt grinder has been developed by the Hill Acme Co., Cleveland, Ohio, for grinding and polishing flat and tapered aluminum aircraft wings and fuselage skins. This machine has a hydraulically operated table 84 inches wide by 16 feet long, and uses endless factory-coated abrasive belts 138 inches long by 86 inches wide.

This precision grinder, Fig. 1, is driven by a 250-H.P., direct-current motor. A coarse grit silicon-carbide abrasive belt is used for heavy stock removal and for grinding to close tolerances. Heavy grinding, as well as finishing, operations are performed by using waterproof cloth abrasive belts together with an efficient coolant system that prevents the temperature from increasing beyond the point at which metallurgical changes occur in aluminum aircraft sections. The abrasive belt travels over an upper steel idler roll and a lower contact or driving roll. A pneumatic belt-centering device insures positive tracking of the abrasive belt irrespective of dirt or moisture. The abrasive-belt grinding head aspartly removed from its housing.

A pneumatic arrangement provides for rapidly raising and lowering the upper steel idler roll when the abrasive belt is to be changed and also maintains the belt at a constant and uniform tension. Two motors are used for the vertical operation of the entire abrasive-belt grinding head assembly. A 3-H.P. constant-speed motor connected by means of a gear-box to the elevating screws raises and lowers the entire grinding head assembly at the rate of

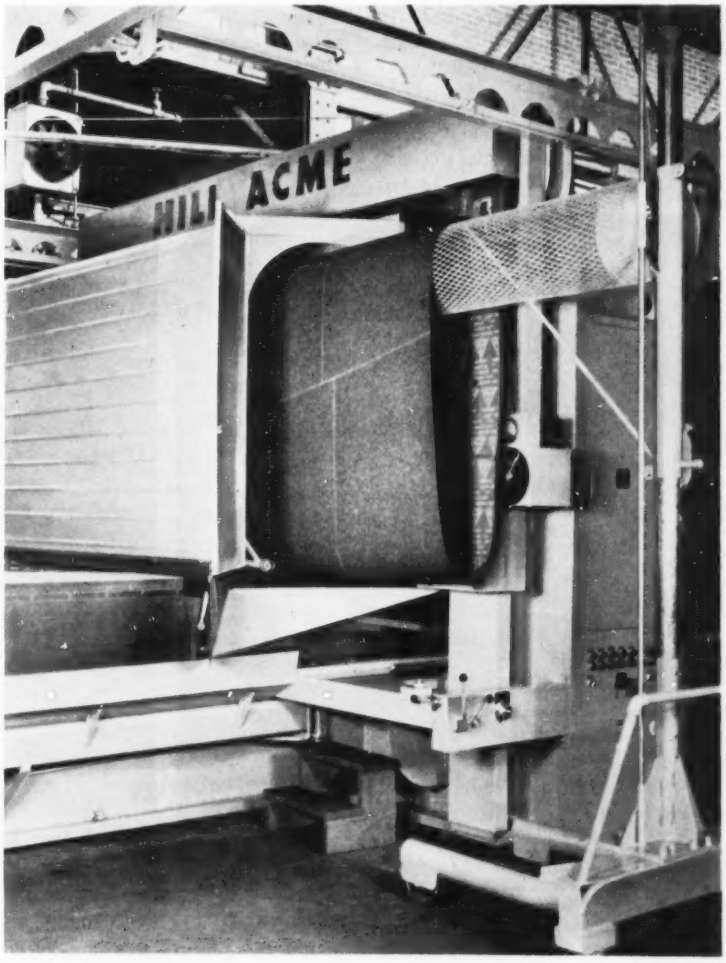


Fig. 2. Close-up of abrasive belt being removed from housing of machine

5 inches per minute and is used for initially positioning the abrasive belt over the work. A 1-H.P. geared motor is connected by means of a magnetic clutch to the elevating screws. This motor is used for accurate positioning and feeding of the abrasive belt into the work, precision setting within 0.00025 inch being readily accomplished. The vacuum chuck that holds the work is equipped with a rubber gasket to conform to the various shaped wings and fuselage sections to be ground. Safety stops are provided so that at no time can the material being processed slide off the vacuum chuck.

Auxiliary equipment includes an overhead crane assembly consisting of rails extending to the unloading or discharging end of the machine, together with the bridge rail and a budget hoist. This hoist, shown near the upper left-hand corner of Fig. 1, is equipped with a vacuum cup pick-up mechanism to facilitate loading and unloading large aluminum plates. 115

Two-Station Universal Gear Chamfering Machine

A two-station universal gear deburring and chamfering machine, Model BME-24, is the latest addition to the Burr-Master line of production gear-finishing equipment made by the Modern Industrial Engineering Co., Detroit, Mich. This machine is designed to handle all spur and helical gears, as well as straight and involute external splines, in a pitch diameter range of from 5/8 inch to 6 1/2 inches. It is essentially a high-production machine with versatility and quick change-over features that make it adaptable to moderate length or short-run production. The two stations can be tooled to perform identical operations at both stations or successive steps on the same gear; or deburr and chamfer parts that are totally different. Once started, the machine operates continuously, chamfering the entire tooth form, including both sides of the tooth and root.

The machine cycle is simple, permitting even an inexperienced operator to realize maximum production. A part placed on the work-spindle moves a cycle indicator arm to its starting position. Operation is then automatic until a signal light indicates completion of the cycle.

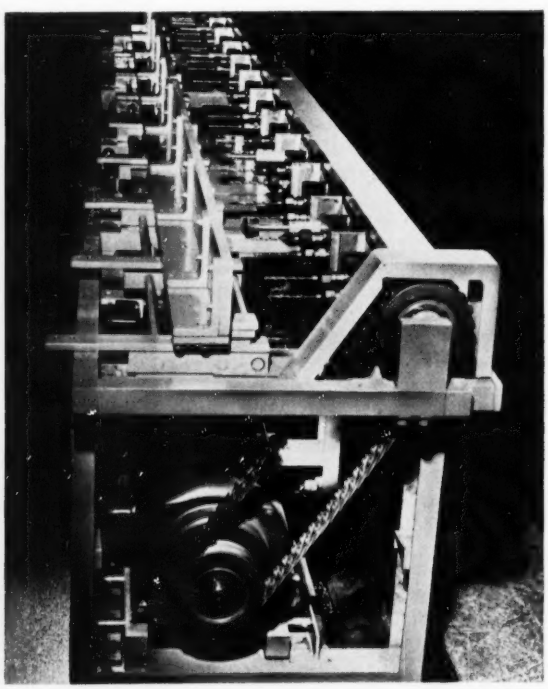
A feature of the machine is the ease with which it can be retooled or changed from one job to another. Normally, an operator can retool each station in ten minutes. The tooling consists of a readily removable pilot gear, tool-block, and form cutter. Precision tooling is developed for each particular gear or spline at the manufacturer's plant on master machines. This tooling is then interchangeable with that on any Burr-Master for which it was developed. . 116

"Gangdriller" Multiple-Spindle Drilling, Boring, and Tapping Machine

A multiple-spindle adjustable drilling, boring, and tapping machine has been placed on the market by the Gangdriller Machine Works, Inc., Brooklyn, N. Y. This machine is designed to reduce the cost of production of work-pieces up to 20 feet in length by 36 inches wide. It will machine with one stroke as many as 100 holes of practically any lay-out pattern with a high degree of accuracy.

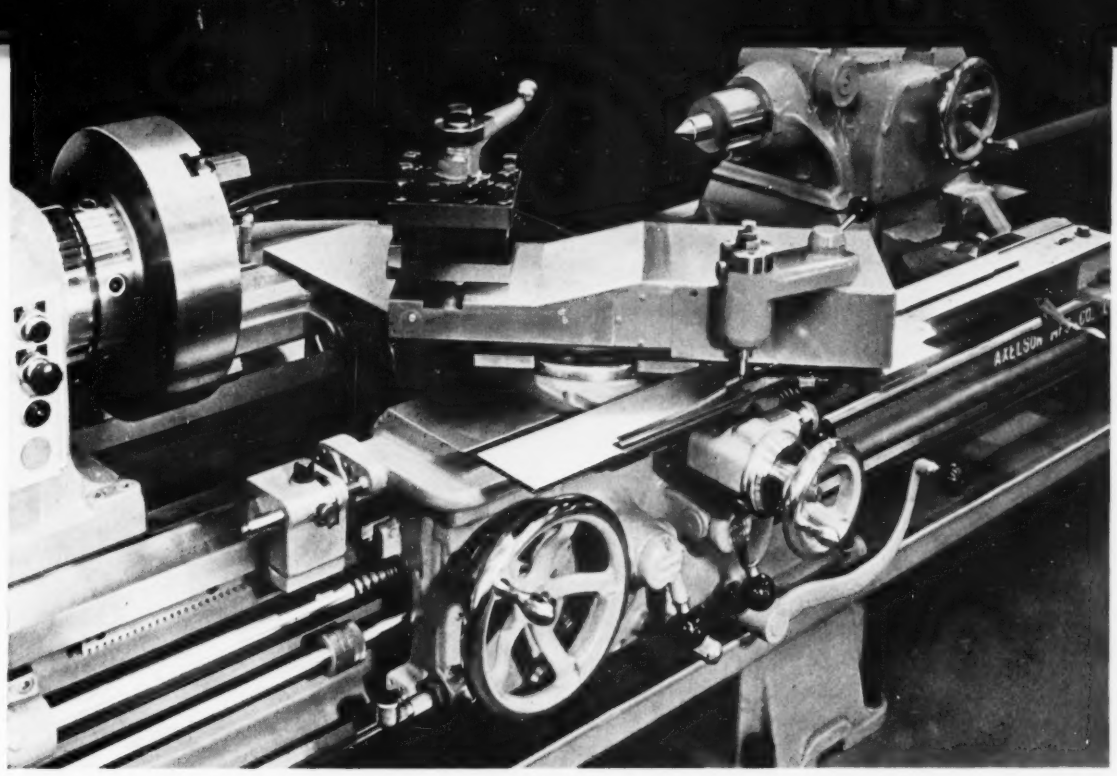
The "Gangdriller," as this machine is called, will automatically position, clamp, drill, bore, or tap various materials as well as steel, handling parts of any shape, as fast as they can be loaded and unloaded. Provision is made for an

Universal gear deburring and chamfering machine made by the Modern Industrial Engineering Co.



Multiple-spindle drilling, boring, and tapping machine introduced by Gangdriller Machine Works, Inc.

For more information on these products, use Inquiry Card, page 265



Axelson lathe equipped with Trace-O-Matic hydraulic tracing attachment

infinitely variable rate of feed for the hydraulically powered table. The machine is produced in both horizontal and vertical types, with throat capacities of 18 and 36 inches. It is made in five working lengths, ranging from 4 to 20 feet, with from sixteen to eighty single spindles.

The spindles can be adjusted longitudinally anywhere in the length of the machine, and vertically 1 1/2 inches on the horizontal model and 6 inches on the vertical model. They can also be adjusted transversely anywhere within the throat depth of 18 or 36 inches. The minimum center-to-center distance of the spindles is 3 inches for the horizontal and 3 1/2 inches for the vertical machines. Spindle speeds range from 900 to 2000 R.P.M. The work-table travel is adjustable up to 6 inches to suit machining requirements. ... 117

Armstrong Ground Cut-Off Blades

A new line of high-speed steel ground cut-off blades is announced by Armstrong Bros. Tool Co., Chicago, Ill. These blades are ground on all four sides. They are available in eight sizes, ranging from 3/32 by 1/2 by 4 1/2 inches to 1/4 by 1 3/8 by 7 inches. There are two series—one for use in straight and right-hand offset tools, and the other for left-hand offset tools. 118

Axelson Hydraulic Tracer Attachment for Lathe

A hydraulic tracer attachment called the "Trace-O-Matic" has been brought out by the Axelson Mfg. Co. Division, Pressed Steel Car Co., Inc., Los Angeles, Calif., for use on Axelson general-purpose lathes. With this attachment, the lathes are converted into contour-turning production machines. Production turning, however, is said to be only one of the advantages obtained. Exceptional cost reductions and economical handling of a variety of work that formerly presented difficult production problems are other advantages claimed for this equipment.

Initial installation requires a few hours and changing back to a standard lathe takes about fifteen minutes. No special skill or training is required to operate the attachment.

Parts are duplicated from flat inexpensive templates which can be put on the machine quickly and which also serve for both roughing and finishing work. The stylus exerts only a few ounces of pressure on the soft template, thus eliminating expensive, hardened and ground templates. Templates are often corrected by hand filing at the machine.

In normal operation, the template is aligned and cuts are made with the finishing tool on the first work diameter until it is turned to the required size. The stylus arm is then swung into place and adjusted to bring the stylus into contact with the template. The standard cross-feed dial allows diameter sizing to 0.001 inch and thereafter the template automatically sizes all other diameters and contours. Lengths are then set to 0.001 inch by a graduated dial on the template holder.

All classes of work with uninterrupted cuts are handled automatically with the Trace-O-Matic, including parts having square or tapered shoulders, flanges, radii, tapers, grinding necks, steps, and contours. Close contour tolerances can be maintained, the finished dimensions of the work having practically the same tolerances as the templates.

Although tool bits of any material can be used, tungsten-carbide tools of the single-point type are preferred. The tools are held in a quick-indexing square toolpost which generally permits three roughing and one finishing tool to be brought quickly into position. Standard or quick-change toolblocks can often be set in advance to save time when changing from dull to sharpened tools.

After setting up the machine, the operation becomes simply one of loading and unloading the work. Since the precision of the template is reproduced in the finished work automatically, it is unnecessary to stop the machine for constant measuring or checking. 119

High-Speed Steel Broaches Made to Finish External Surfaces on Circular Parts

A new line of "Red Ring" broaches for finishing slots, flats, notches, and contours on external surfaces of circular metal parts is being brought out by the National Broach & Machine Co., Detroit, Mich. The broaches are made in a wide variety of sizes in two general types: an external surface broach type and an internal type. The surface broach type machines up to half the periphery of a part in a single pass of the broach. If broaching is required around the entire periphery, the part is indexed and completed by a second pass of the broach.

The internal type of broach is mounted on the table of conventional utility hydraulic presses and finishes the entire periphery of the part. In this arrangement, the part is mounted on a holder on the end of the press piston-rod and pushed down through the broach.

The 48-inch long external surface broach shown at the left in the illustration broaches 36 unequally spaced 0.050-inch wide, 3/16-inch deep slots in a 3 1/2-inch diameter, 5/16-inch thick steel automotive transmission hub. The broach is made up of two sections, the second section broaching the slots between those produced by the first. The part is indexed for a second pass of the broach to complete the operation. This setup produces ninety hubs an hour.

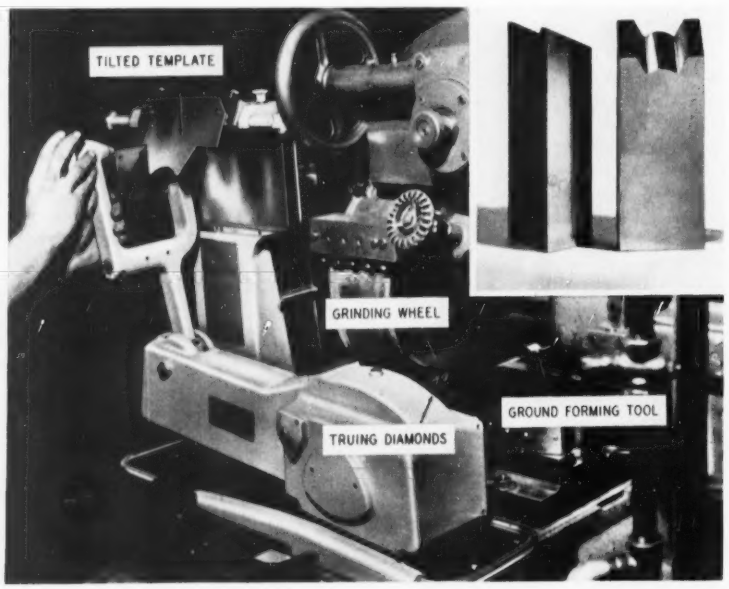
The 15-inch long internal broach shown at the right in the illustration broaches six equally spaced 1/4-inch wide, 1/16-inch deep crimping slots in a 3 5/8-inch diameter, 14-inch thick flange at the rate of 600 parts an hour. 120

Two "Red Ring" broaches that finish external surfaces on circular metal parts

Pratt & Whitney Wheel-Forming Attachment

A new Diaform wheel-forming attachment, designed to simplify the grinding of relief angles on forming tools, has been announced by Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn. This attachment, which works on the well-known pantograph principle, is called the Series "R" Diaform with relief angle compensator. It has been developed to eliminate the need for distorted templates, projection drawings, and lengthy calculations.

In operation, the template is mounted on its carrier, which has graduated scales, and the carrier is tilted to the included angle of both the end relief and top rake. For side relief, the entire carrier is swiveled outward to the desired angle. The wheel is form-trued by lightly traversing the tracing bar over the profile of the tilted and swiveled template. The path of the tracer is transmitted through the pantograph mechanism at a 5 to 1 or 10 to 1 reduction ratio (depending on the model Diaform, of which there are three) to the truing diamonds. 121



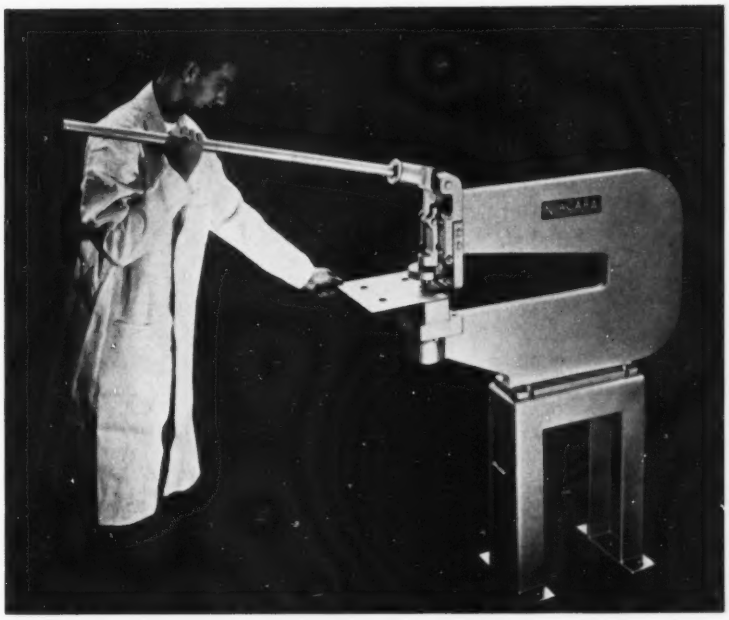
P & W wheel-forming attachment applied to tool grinding machine

For more information on these products, use Inquiry Card, page 265

Niagara Deep-Throat Lever Punch and Shear

A deep-throat lever punch and shear capable of handling a large variety of work is being built by the Niagara Machine & Tool Works, Buffalo, N. Y. With a 5-ton capacity and 24-inch throat, this new machine is well-suited to the needs of sheet-metal shops, maintenance departments, and experimental and model shops. It permits accurate, smooth shearing to straight lines or intricate shapes, as well as numerous types of punching and notching. The shear cuts from front to back or left to right and will slit sheets of any length. Sheets up to 48 inches wide can be slit down the center.

The machine can be equipped for use either as a punch or a shear, or both, and is readily converted from one to the other. A large selection of punches and dies is available for punching simple or intricate holes, notching, corner trimming, combination trimming, and cut-off operations. Narrow die shoes can be used for punching deep-legged channels and angles, and wide die shoes can be employed for larger diameter work as well as dies of special shape. 122



Deep-throat punch and shear made by the Niagara Machine & Tool Works

Huge Press for Bending Ship Keels Equipped with Walking Beam

The Clearing Machine Corporation, Chicago, Ill., has recently built a mammoth keel-bending press which is used in the construction of ocean-going vessels. This press forms steel plate many inches thick to the contours of keel and hull and makes it possible to hold shapes to close tolerances.

Conventional presses have a vertically moving slide or ram, but this machine has a walking beam which can exert a pressure of 1800 tons vertically and can also rock on a central axis. The maximum pressure exerted by each end of the walking beam is 900 tons. The beam is pivoted in a pair of guided slides through two spring-centered levers that permit the beam to move horizontally 1 1/2 inches to either left or right of center. This movement enables the operator to

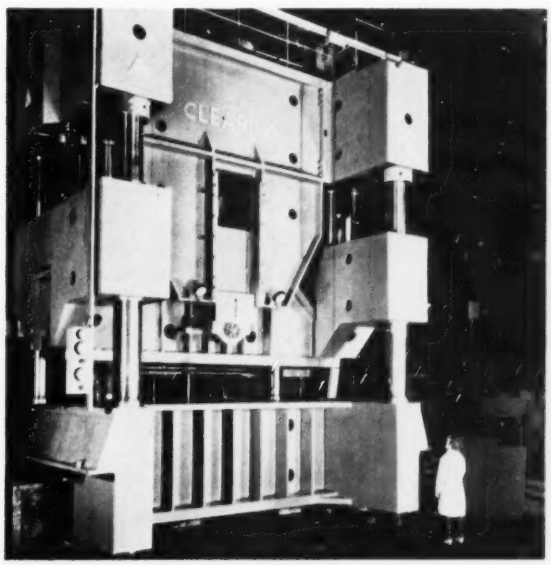


Fig. 1. Clearing keel-bending press with walking beam in horizontal position

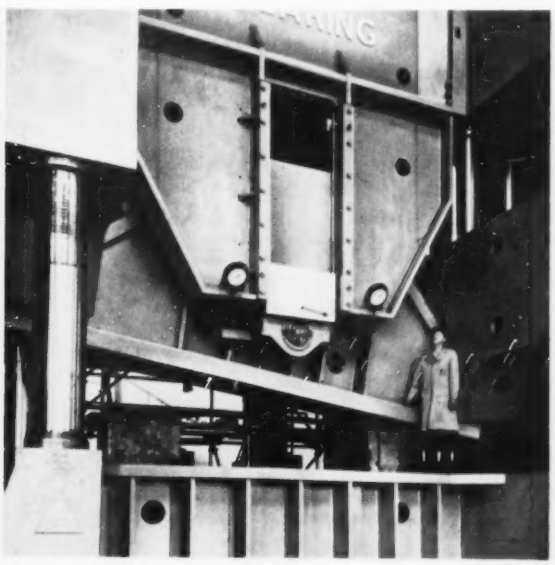


Fig. 2. Mammoth press shown in Fig. 1 with the walking beam tilted to right

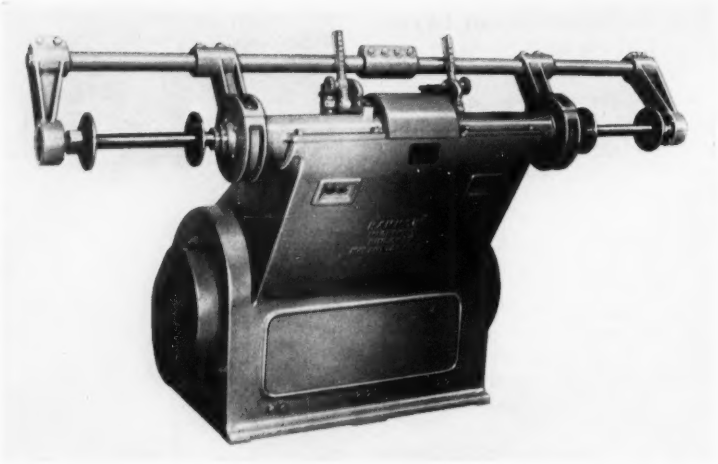
hold pressure on one end while lowering the other end of the beam, thus effecting a rolling action of the moving-beam die over the work.

The maximum tilt or "slew" is 30 inches in the 20-foot length of the walking beam. Pressure delivered to each moving member is independently controlled at the panel mounted on the left side of the press. 123

Hammond Two-Spindle Wide-Swing Polishing and Buffing Lathe

A special wide-swing polishing and buffing lathe is being announced by Hammond Machinery Builders, Inc., Kalamazoo, Mich. This Model RRO is a two-spindle lathe, each spindle having its own motor, motor control and V-belt drive—allowing one operator to change wheels without causing "down" time for the other operator. Each spindle runs in three ball bearings, one being at the end of the spindle which is a part of the special outboard bearing assembly.

The heavy-duty construction and rigidity of the outboard bearing of this machine permit the use of wheels having face widths up to 16 inches. The lathe is especially suited for polishing and buffing large and irregular-shaped parts, either by hand polishing or in conjunction with semi-automatics. 124



Wide-swing polishing and buffing lathe has been brought out by Hammond Machinery Builders, Inc.

"Hermes" Shaper

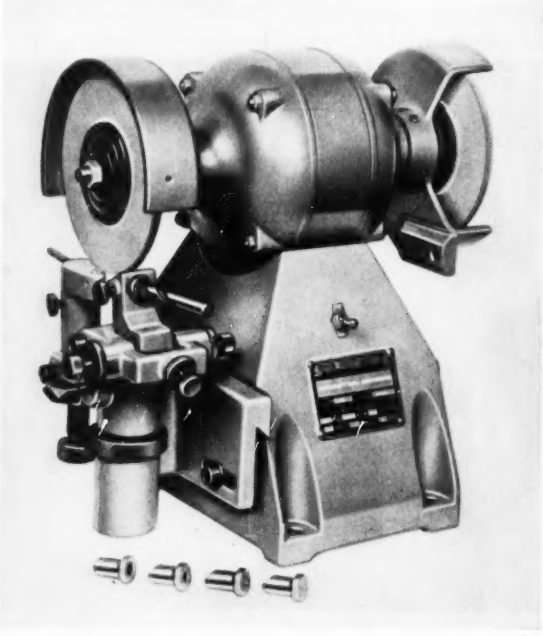
Morey Machinery Co., Inc., New York City, is placing on the American market a new shaper known as the "Hermes." This compact shaper is easy to operate and is built for accurate work. Low initial cost and simplified tooling are outstanding features claimed for this machine.

The raw materials used in the construction of these shapers are carefully selected and rigorously controlled. Cast-iron pieces are of high-tensile Meehanite. The shapers are available in seven sizes ranging from 8 to 30 inches. 125

Drill Point Grinder

A machine for grinding crankshaft type drill points developed in the Athol, Mass., plant of the Union Twist Drill Co., and used there for some time, is now avail-

"Hermes" shaper introduced by Morey Machinery Co., Inc.



Drill point grinder marketed by Union Twist Drill Co.

For more information on these products, use Inquiry Card, page 265

able to the trade. This drill point grinder provides a fast, accurate method of grinding crankshaft points on drills ranging in size from No. 1 through 50, A through U, and 3/64 through 3/8 inch.

In operation, the drill is rocked into the wheel to grind one notch, returned, indexed 180 degrees, and the operation repeated for the other notch. An adjustable diamond truing device dresses the wheel with one quick motion. There is a tilting fixture which is adjustable for any sharpening angle, and flute guiding drill bushings can be furnished for each size of drill to be ground.

The motorized spindle is precision ground, has preloaded ball bearings and is equipped with a 6-inch grinding wheel at one end and a 6-inch general utility wheel at the other end. The 1/4-H.P., 110-volt, 60-cycle, 3450-R.P.M. motor is fully enclosed.

The crankshaft method of pointing drills consists of cutting away, or notching, the drill point in such a way that the usual chisel edge becomes a pair of secondary cutting lips, leaving virtually no web thickness at the center. This improves the cutting action so that the center of the drill, instead of smearing or extruding the material under the chisel edge, removes two clean-cut secondary chips.

The crankshaft type point is well suited for deep-hole drilling and for drilling stainless-steel, aircraft skins, and various tough alloy materials. 126

Fig. 1. Electronic airfoil-milling machine with headstock at middle of bed, and a tailstock and carriage at each end. Work is machined at right-hand end, using the controls at left-hand end.

Electronically Equipped Machine for Milling Original Master Airfoils

A Model 102 electronic airfoil-milling machine manufactured by the New England Machine & Tool Co., Berlin, Conn., has been announced by the Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn., which will handle the sales engineering and servicing of the machine.

Two completely new developments—a non-contacting tracer control and a fair-curve interpolating system—are combined in this machine for generating original three-dimension contoured shapes from a series of simple cross-sectional templates. The machine, although not previously offered to industry, has been used for six years in actual job-shop manufacturing of original airfoil masters; master cams for production airfoil-milling and grinding machines; metal patterns for various blade casting processes; and general experimental and prototype machining of airfoil shapes.

The novel system of correctly interpolating between corresponding points on various cross-sections (and extrapolating beyond them) while continuously producing the proper "twist" in the airfoil, also permits developing blades with various experimental twist conditions without changing the basic set-up. A completely new blade shape can be produced from the drawing in a matter of hours, rather than weeks, and without depending on cut-and-try methods.

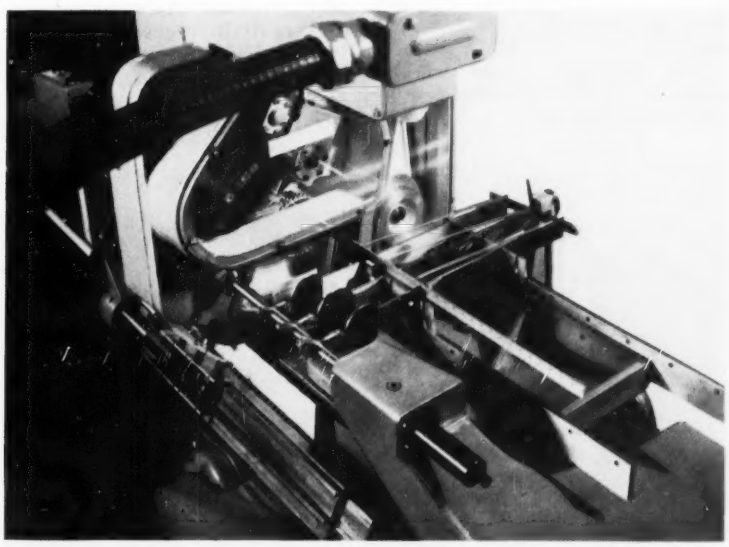


Fig. 2. Control end of airfoil-milling machine, showing the stack of cross-sectional templates and interpolating mechansim.

For more information on these products, use Inquiry Card, page 265

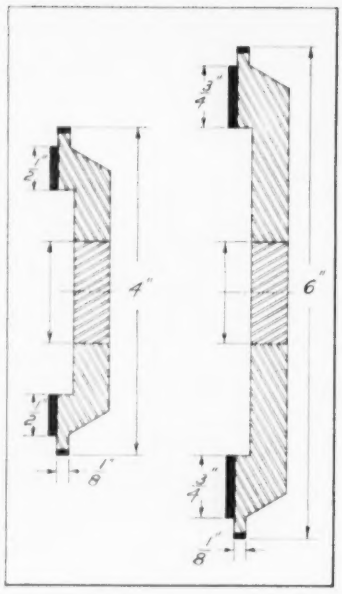
Interpolation is accomplished through the use of commercial feeler-stock which acts as a continuously flexing spline, constantly representing successive fairing elements of an imaginary master blade having proper cross-sectional shape, but lacking twist. "Twist-of-shape" is concurrently introduced by a programmed rotation of templates relative to workpiece rotation.

The electronic non-contacting tracer operates through a measured 0.001-inch length spark-gap and permits accurate following of the flexing feeler-stock, since it never contacts it. This is said to be the most accurate tracer control system now in use. The machine is capable of speed ranges of about 25 inches per minute. 127

Taft-Peirce "Multiplex" Angle-Irons

The Taft-Peirce Mfg. Co., Woonsocket, R. I., has announced the addition of "Multiplex" angle-irons to its line of precision tool-room and inspection equipment. These general-purpose irons are made of high-quality cast iron, carefully normalized, and have all surfaces scraped for accurate flatness and squareness.

A standard model, 12 inches long, 12 inches wide, and 12 inches high, can be furnished from stock. Holes and slots provide for clamping bolts, and four tapped holes accommodate eyebolts to facilitate handling. Two recessed lips in the base simplify clamping to machine or inspection tables. All working surfaces are square within 0.0005 inch in 6 inches and parallelism of the sides is held to a tolerance of 0.0005 inch. ... 128



"Chip-A-Lap" diamond tool-grinding wheels shown cross-sectionally

"Chip-A-Lap" Wheels for Grinding Carbide Tools

"Chip-A-Lap" diamond wheels for grinding carbide tools have been brought out in two sizes, with dimensions as shown in the accompanying illustration, by the A.I.T. Diamond Tool Co., Chicago, Ill. The wheels are made with an "Al-Aloid" bond for wet grinding and with a resin bond for dry grinding. The depth of the 1/8-inch wide diamond rim on the periphery of the wheels is 1/16-inch, and the depth of the 3/4-inch wide diamond face is 1/32 inch.

The "Al-Aloid" bond wheels make it possible for plunge grinding, shaping, hogging, and radius grinding to be done on one machine. For chip breaking and surface grinding, this wheel can be used exactly the same as a conventional peripheral type wheel. With the Al-Aloid wheel, plunge grinding can, for example, be done with a 150-grit peripheral section and radius grinding with a 220-grit face section.

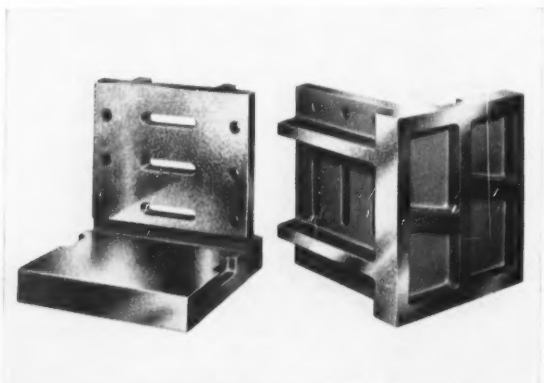
Shaping and radius forming can be done on the face section of the resin bond dry grinding wheels, and surface grinding and chip breaking on the periphery of this type wheel. 129

"Dializers" for Converting Adjustable Limit Snap Gage Frames to Dial Type Gages

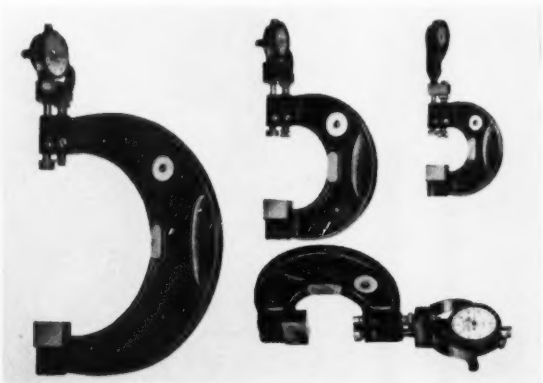
A development in its line of "Dializers" has been announced by the Standard Gage Co., Inc., Poughkeepsie, N. Y. The Dializers will convert standard (AGD) adjustable limit snap-gage frames to dial snap gages. Previously furnished with a 1 1/8-inch diameter indicator, these instruments are now available with either a 1 3/4- or a 2 1/4-inch diameter indicator. Besides making it possible to select the size of dial suited to an operation, there is also afforded a choice of 0.001-, 0.00025-, 0.0005-, and 0.0001-inch graduations.

Dializer snap gages can be made up from AGD snap gage frames of any make to measure diameters up to 11 5/8 inches. Frames above the AGD range are available for measuring larger diameters up to 26 5/8 inches. Dializers will also convert AGD progressive type adjustable limit length gages to dial instruments. 130

(*This section continued on page* 257)



"Multiplex" angle-irons added to line of tool-room and inspection equipment made by Taft-Peirce Mfg. Co.



Adjustable limit snap gage frame converted to dial type snap gages announced by Standard Gage Co., Inc.

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Relax! Hold to a Tenth and Break Production Records

. . . with the No. 5 Plain Grinding Machine. You conserve time, motion, and effort with the No. 5, and consistently grind small parts to a tenth or less! The recessed design of the base and convenient grouping of all controls permit your operators to sit comfortably at the machine while maintaining highest production. Automatic cycles reduce operator's task to loading, starting, and unloading. When equipped with ELECTRALIGN, alignment control to 0.0001" becomes simple and positive. Get the complete story . . . write for detailed Bulletin on the No. 5—one of an outstanding line of 18 Grinding Machines offered by Brown & Sharpe.

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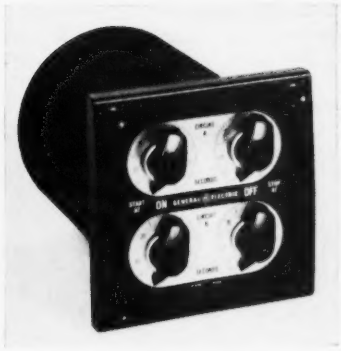


Redesigned process timer announced by the General Electric Co.

General Electric Redesigned Process Timer

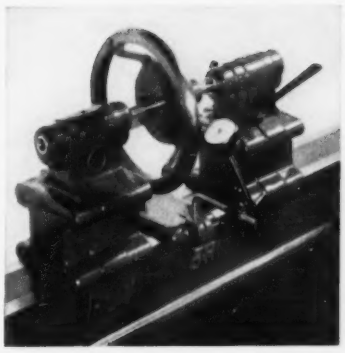
A redesigned process timer, Type TSA-18, is announced by the General Electric Co., Schenectady, N. Y. This timer can be used to control hydraulic presses, baking equipment, mixing machines, heat-treating ovens, and other equipment. Improved features include extra heavy nylon gears, over-all construction of almost 100 per cent pure zinc alloys, and a dust-resistant cover.

An internally engraved connection diagram together with screw type terminals permit easy wiring of the timer, which is available in single-circuit or two-circuit models. Any combination of single and two-circuit units can be utilized to control three, four, ten, or more circuits. Equipped with a bevel for semi-flush mounting, the timer requires a minimum of mounting facilities on switchboards and control panels. It measures 5 3/4 by 5 3/4 by 8 5/32 inches, weighs 6 3/4 pounds, and operates on a power supply of 60, 50 or 25 cycles, with a contact rating of 10 amperes at 120 volts or 5 amperes at 240 volts. . . . 131

Brown & Sharpe Improved Bench Centers

The Brown & Sharpe Mfg. Co., Providence, R. I., has recently improved the design of its bench centers. A typical set-up, with the centers on optionally furnished raising blocks, is shown in the illustration. The bed of the bench centers has been streamlined and modernized. It is of U-shaped cross-section, heavily ribbed, and has a three-point bearing. The headstock and footstock are adjustable individually and can be locked securely in any position on the bed. The spring-actuated center may be locked in position to support heavy work.

Bench centers are supplied with or without dial test indicators. The dial gage reads to 0.0005 inch, but dial gages reading to 0.0001 inch can be furnished. The headstock and footstock centers swing work 8 inches in diameter, and take work up to 36 inches long. Raising blocks with a height of 4 inches are available, which increase the swing capacity to 16 inches.



Improved bench centers brought out by the Brown & Sharpe Mfg. Co.

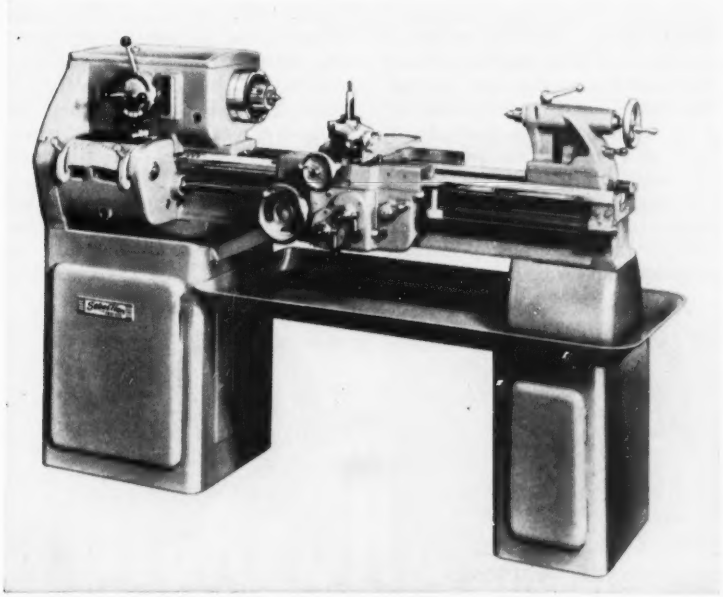
The bench centers provide a simple, accurate means for holding cylindrical work for inspection purposes. Work mounted on an arbor can be checked axially for side run-out or camming action. Where tests to unusually close limits are required, the centers may be lapped to the work and an electronic testing device applied for very fine measuring 132

Sebastian Geared-Head Lathe

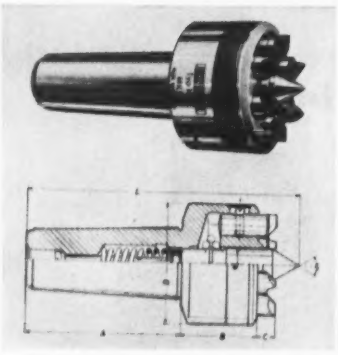
A Sebastian 13-inch geared-head lathe designed to meet the need for a low-cost all-purpose precision machine has been brought out by the Sheldon Machine Co., Inc., Chicago, Ill. Outstanding features of this lathe include the heavy bed, "zero precision" tapered roller bearings that support the spindle, large (1 3/8-inch) hole through the spindle, automatic oiling system, cam-action tailstock clamp, and easy-shifting spindle-speed dial.

Each lathe is rigidly checked, inspection including nineteen accuracy tests. Individual test sheets accompany the lathe when it is shipped from the factory. The thick-walled, hardened and ground, multiple-splined spindle has a long tapered key drive nose.

All gears in the headstock run in oil, are extra wide, and designed for quiet, efficient operation. The enclosed gear-box provides for sixty different pitches and feeds. A lead-screw reverse lever is incorporated in the gear-box design. Two friction disc type clutches in the large apron provide power longitudinal and cross feeds. These clutches can be engaged individually or simultaneously. 133



Sebastian geared-head lathe made by the Sheldon Machine Co., Inc.



Mera automatic work-driving center

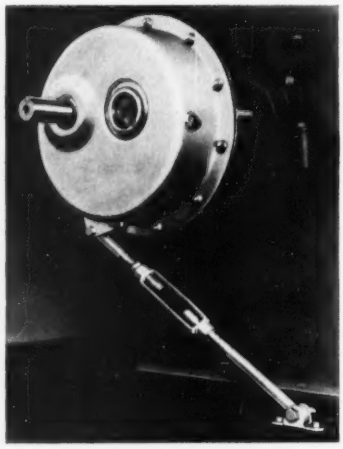
Mera Work-Driving Center

An automatic driving center has been brought out by the Mera Machine & Mfg. Corporation, Elizabeth, N. J., for use in turning, milling, and grinding work. This center permits the work-piece to be removed and re-chucked while the machine is running without danger of injury to the operator. With this work-driving center, many jobs can be finished complete in one set-up. Longitudinally movable driving pins grip the work-piece regardless of any irregularities in its end face. When the work-piece has been gripped, the center is automatically locked to insure precision and safety. 134

Portable Potentiometer for Checking and Calibrating Temperature Instruments

Greater flexibility in checking and calibrating temperature measurement and control instruments is made possible by the Wheelco Series 300 portable potentiometer, which was recently announced by the Wheelco Instruments Division, Barber-Colman Co., Rockford, Ill. This potentiometer, housed in a sturdy, lightweight aluminum frame, is suited for precise laboratory work, as well as for maintenance and service work in the plant or field. It may be used with all commercial thermocouples.

The large 40-inch scale is readable to 0.025 millivolts. A built-in thermometer facilitates measuring cold junction temperatures. The potentiometer has a special compartment for dry cells that supply current to energize instruments during calibration checks. Six standard models are now in production. 135



Shaft-mounted speed reducer made by the Falk Corporation

Falk Shaft-Mounted Drive

The Falk Corporation, Milwaukee, Wis., has announced a new speed reducer that can be mounted directly on the shaft to be driven and requires only sufficient floor space for the motor and tie-rod. This drive can be easily adapted to fit various driven-shaft diameters and offers comparatively high ratios of speed reduction. It is available in either a single- or double-reduction unit, making possible the selection of almost any output speed between 420 and 14 R.P.M., merely by changing sheave sizes within allowable limits. Six sizes cover the range from 1/2 to 30 H.P. The unit is of all-steel construction, and has helical gearing and a positive lubrication system. 136

Allis-Chalmers Induction Motors

The Allis-Chalmers Mfg. Co., Milwaukee, Wis., has brought out a complete line of alternating-current squirrel cage induction motors in frame sizes 326 and smaller, known as the Type G. A 5-H.P., 1800-R.P.M. general purpose NEMA design B drip-proof, squirrel cage motor built on the present 254 frame meets the following standards: temperature rise, 40 degrees C.; locked rotor torque, 185 per cent minimum; breakdown torque, 225 per cent minimum; locked rotor current at 220 volts, 90 amperes maximum; slip, 5 per cent maximum; and service factor, 1.15. Under the new standards, the 5-H.P., 1800-R.P.M. motor will be on the 215 frame. No performance standards will be altered.

The new motors will be similar to present designs in appearance. They will have cast-iron frames and end shields. Rotors will be pressure-cast of aluminum. Bearings will be of the grease-lubricated, medium series, double-shielded ball-bearing type capable of lubrication without dismantling the motor. Stator windings will be the random or mush wound type of heavy Formvar-coated wire in semi-closed slots. Stators will receive multiple dips and bakes to assure protection against moderate amounts of moisture, weak acids, and alkalies.

Intake openings in the end shields will have greater protection from dust than in the old designs. All motors will be fan-cooled. They are available in frame sizes 182 and 184. 137

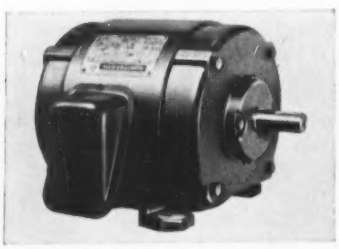


Fig. 1. Allis-Chalmers Type G open drip-proof motor

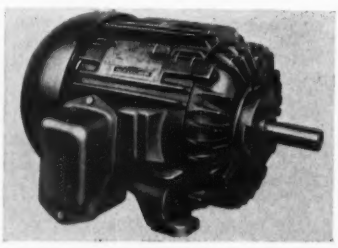


Fig. 2. Heavy-duty totally enclosed fan-cooled Allis-Chalmers motors

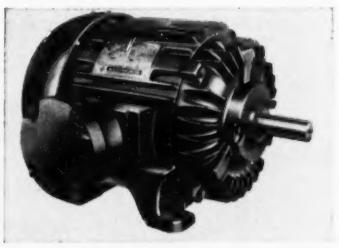
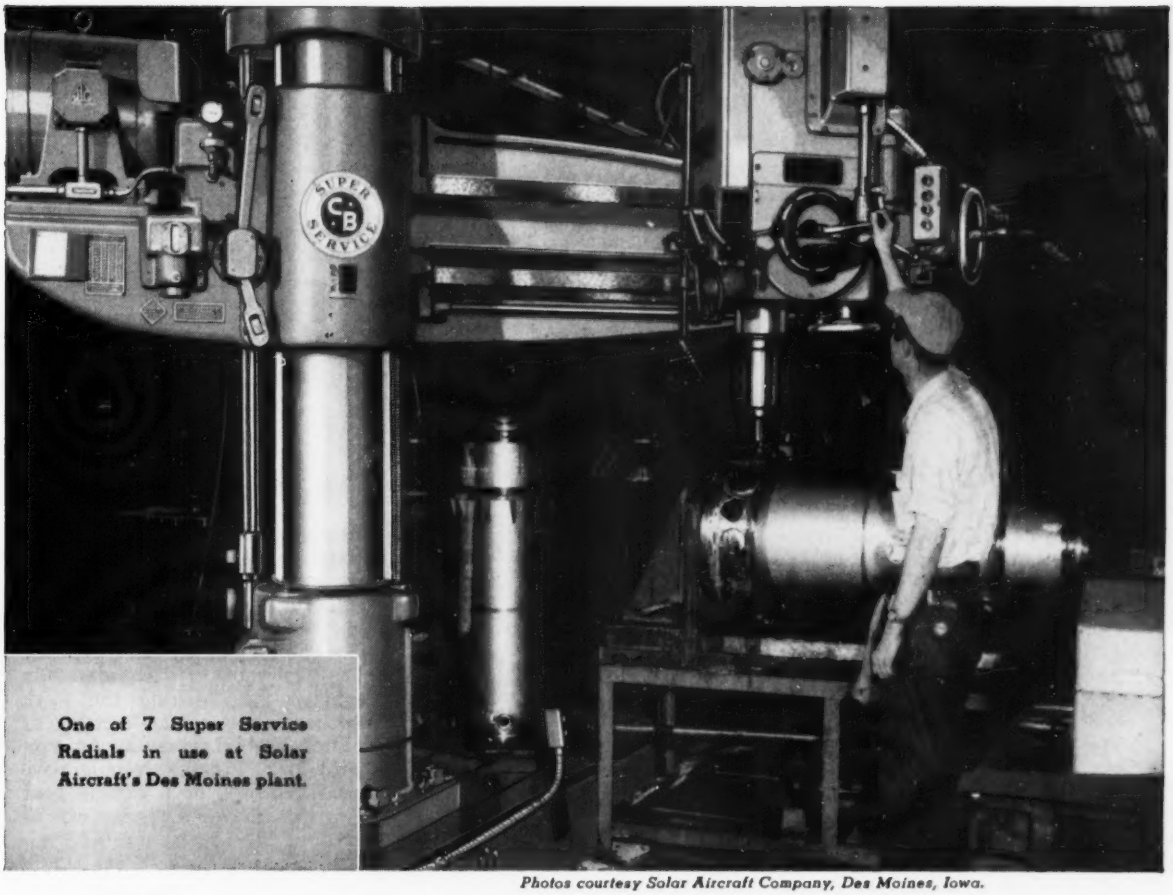


Fig. 3. Allis-Chalmers explosion-proof motor

For more information on these products, use Inquiry Card, page 265



One of 7 Super Service Radials in use at Solar Aircraft's Des Moines plant.

Photos courtesy Solar Aircraft Company, Des Moines, Iowa.

"well pleased..."

"Our production people and our plant engineering department, who install and service equipment, are well pleased with our Cincinnati Bickford drilling machines." • **Solar Aircraft Company**

Both large and small Cincinnati Bickford Super Service Radial Drills are used here in producing jet engine components. The arm of the machine shown above is swinging over two working positions permitting the completion of all drilling operations at both stations with a minimum of work handling. Altogether there are 10 holes drilled and reamed, 18 holes drilled and tapped, and two .656" dia. half moon radii accurately machined in this tough high-alloy steel. The accuracy, speed and trouble-free performance, the power and easy control of these machines have made them popular to both engineers and operators.

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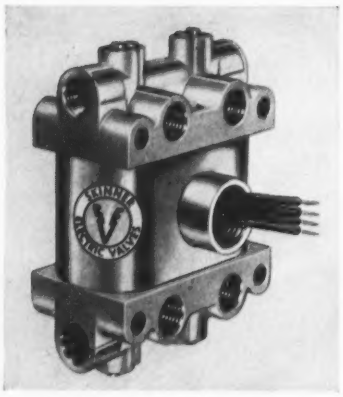
SUPER SERVICE CB RADIAL AND UPRIGHT DRILLING MACHINES

THE CINCINNATI BICKFORD TOOL CO.

Cincinnati 9, Ohio, U.S.A.

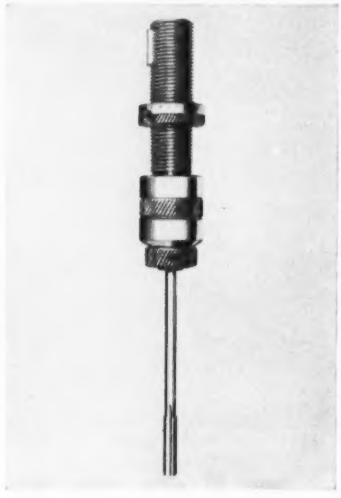


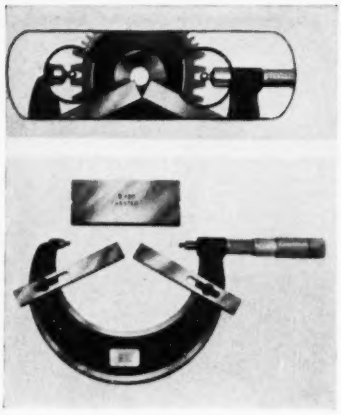
Skinner Small-Size Four-Way Solenoid Valve

Small-size four-way solenoid-operated valve brought out by the Skinner Electric Valve Division, Skinner Chuck Co., New Britain, Conn. This Series V9 valve is only 4 5/16 inches high. It is leakproof, is suitable for air, hydraulic oils, and other common media, and will operate in any position. The valve can be used to control one double-acting cylinder or two single-acting cylinders. A wide range of applications is made possible by the 176 standard variations in capacities and types that are available. Three basic types are offered: normally open; normally closed; or a combination of the two. Pressures range from 0 to 150 pounds per square inch and orifice diameters from 3/64 to 1/8 inch. The valves are available for all common alternating- and direct-current voltages. All pipe connections are 1/4 inch NPT. . . 138

Floating Tap and Reamer Holder with "Lock-and-Eject" Collet Action

"Lock-and-eject" type floating tool-holder announced by Scully-Jones & Co., Chicago, Ill. This "JT" holder requires no drift for ejecting tools and provides for faster, easier changing of taps and reamers. Four-split chucks for taps and two-split chucks for reamers are locked and ejected by means of a new threaded nut (revolving on ball bearings on nose of holder), which engages a thread on the end of the chuck. By rotating the threaded nut clockwise, the chuck is drawn into the holder and compressed evenly on the shank of the tool. Opposite rotation unseats the chuck. . . 139



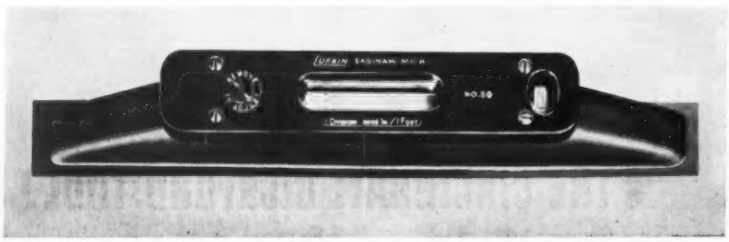


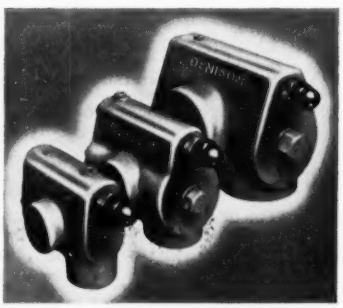
Ball Point Micrometer

Micrometer with opposing ball points integral with the measuring screw and mandrel. The ball points are accurate within limits of 0.0001 inch and permit precision checking of non-parallel parts. The micrometer is especially adapted for checking the tooth thickness and pitch diameter of gears. Master gears can be supplied for making comparative measurements, or a sample gear that has passed inspection can be used for checking purposes. Standard ball sizes range from 1/8 to 1/4 inch by increments of 1/64 inch, but other sizes can be made to order. Product of A. A. Gage Co., Detroit 20, Mich. 141

Lufkin Master Precision Level

The master precision level, No. 59, manufactured by the Lufkin Rule Co., Saginaw, Mich., has wide application in machine shops, inspection departments, tool-rooms, and millwright departments. Its ground and graduated vial is of 10-second angle accuracy, with one division equalling 0.0005 inch per foot. A special alloy base is resistant to temperature change, and the top plate of the level is made of a non-conductive insulating material. Screws have 64 threads per inch for fine, positive adjustments. An auxiliary level shows lateral position. The instrument is 15 inches long, 3 inches high, 1 1/2 inches wide, and weighs about 6 pounds 140





Denison Relief Valves

New line of low-priced relief valves designed to fill the growing demands for efficient pressure-control hydraulic circuits of 2000 pounds per square inch, introduced by the Denison Engineering Co., Columbus, Ohio. They are furnished with threaded bodies for in-the-line or T-type connections and are available in 1/2-, 3/4-, 1 1/4-, and 1 1/2-inch pipe sizes. The valves may be vented or operated by remote control. . . 142

For more information on these products, use Inquiry Card, page 265

See How FORGINGS CAN SAVE MONEY

(Below) This forged brass part was originally made from a casting and a tube, silver soldered, as indicated in the drawing. Forgings can save a lot of money!

(Above) Brass part as now forged in one piece. Drawing shows how it was originally made in three pieces, two made of tube and the other from sheet, silver soldered.

Photos of forgings shown are approximately 3 times larger than actual size.

The two brass parts shown here were originally built up out of separate pieces, silver soldered together. That was the difficult and expensive way. Then the manufacturer and Revere worked together to see if forgings could not be used. Designs and dies were worked out, and for a number of years Revere has kept a steady flow of these parts going to the customer. He reports that the forgings not only save money, but are superior: stronger, more dense, with a better finish, and machining is faster and easier.

If you have sub-assemblies made of several parts, look into forgings. They may offer important economies. Revere makes forgings in copper and its alloys, and aluminum alloys. See the nearest Revere Sales Office.

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COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

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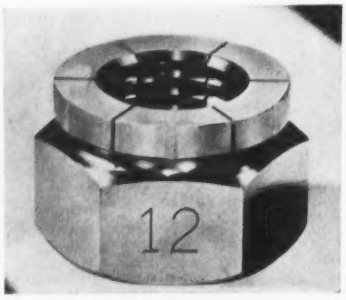
Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y. Sales Offices in Principal Cities. Distributors Everywhere.

SEE "MEET THE PRESS" ON NBC TELEVISION, SUNDAYS

Lock-Nuts for Hot-Spot Applications

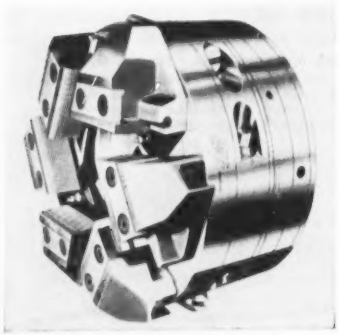
Flexloc self-locking nut developed for high-temperature resisting fasteners used in aircraft engines and industrial processes, placed on the market by the Standard Pressed Steel Co., Jenkintown, Pa. This nut is machined from AMS-

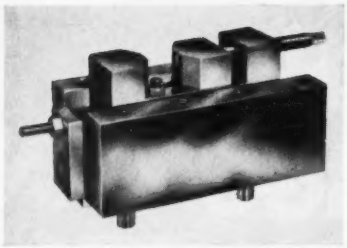


5642 stainless steel and will resist temperatures up to 1200 degrees F. It is capable of withstanding the heat in the tail cone of a gas turbine, and is also designed for such hot-spot applications as exhaust manifold systems, furnaces, and fire-wall assemblies. The nut is silver-plated to eliminate galling and seizure of threads. Under test, it conforms to military specification MIL-N-7873 and is being made in seven standard sizes with diameters ranging from No. 10 through 9/16 inch. ... 143

Die Head for Large-Diameter Threading

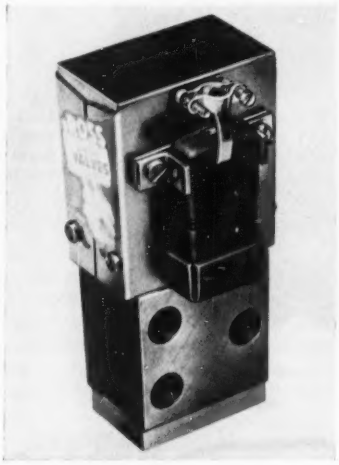
A six-chaser "Lanco" self-opening tangential die head has been introduced by the Landis Machine Co., Waynesboro, Pa. It is a revolving type head for precision, large-diameter threading on the No. 4 Model "C" Landmaco machine. Pipe capacity is 2 1/2 to 6 inches, and bolt capacity is 2 7/8 to 6 5/8 inches. 144





Horton Pinch Type Units for Holding Thin-Walled Parts

Sliding pinch type units for holding thin-walled parts without distortion on chucks or faceplates are available from the Horton Chuck Division of the E. Horton & Son Co., Windsor Locks, Conn. Any number and arrangement of these units to suit the work can be mounted in the T-slots of chucks or faceplates. A special floating arrangement permits quick self-alignment of the unit to conform to the work-piece. 145

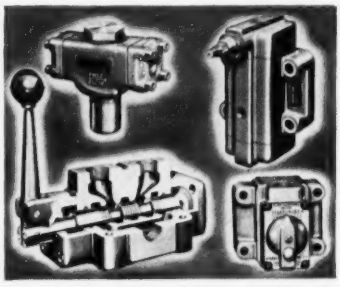


"Comet" Air Control Valve

Air control valve measuring 5 by 2 1/4 by 2 inches and weighing 2 1/2 pounds, capable of operating at 800 or more cycles per minute, announced by Ross Operating Valve Co., Detroit, Mich. This valve, called the "Comet," is one of the smallest four-way, two-position direct solenoid-operated units made by the manufacturer. It can be mounted directly on welding guns, small jigs and fixtures, small bench machines, and similar equipment. The valve has only one moving part and can be serviced by any maintenance man. Available in manifold, sub-base, plate mounting and in-line pipe-tapped body types. 146

H-P-M Hydraulic Valves

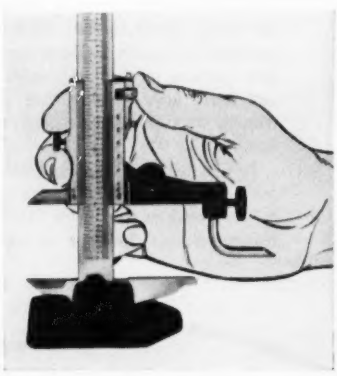
Four of the more than 3500 basic models included in the new H-P-M line of hydraulic valves made by the Hydraulic Press Mfg. Co., Mount Gilead, Ohio. The cut-away view, lower left, shows features of the four-way 2000-pound per square inch threaded valve. At the



top left in the illustration is a 3000-pound per square inch horizontal, pilot-operated check valve with flange connections; at the top right is a 3000-pound per square inch gasket-mounted, vented type relief valve with balanced piston; and at the bottom right a 2000-pound per square inch adjustable flow control valve. This valve is of the automatic pressure compensating type. 147

"Mauser Microlock" Combination Vernier Caliper and Height Gage

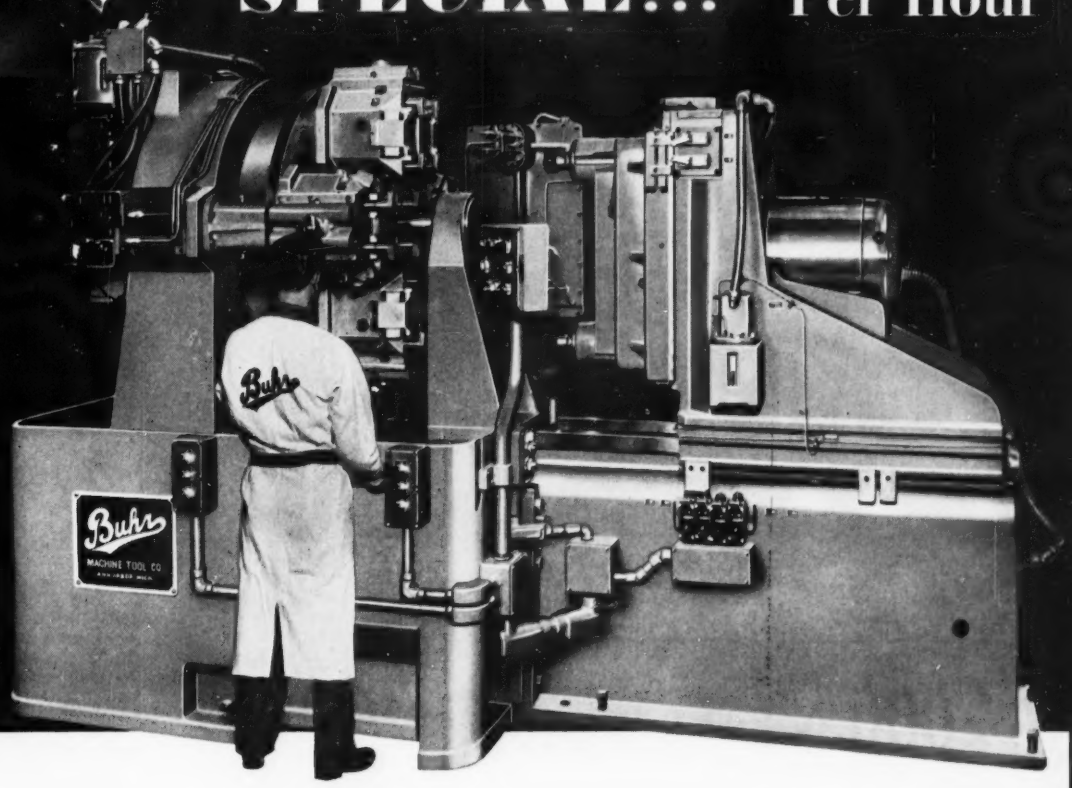
Combination vernier caliper and height gage for toolmakers and mechanics announced by the George Scherr Co., Inc., New York City. This "Microlock" model instrument features an entirely new design, combining time-saving advantages of quick adjustment and rigid tightness of the slide, with a micromatic fine adjustment mechanism. 148



For more information on these products, use Inquiry Card, page 265

Buhr SPECIAL...

Mills and taps 510 Oil Seal Retainers Per Hour



Fixture is arranged with hydraulically operated automatic clamping and automatic index.

Operation: Loading two parts. Station 1 — Load and Clamp.
Station 2 — Tap (2) 5/16-18 Holes and mill two Slots.
Station 3 — Idle.
Station 4 — Tap (2) 5/16-18 Holes and mill two Slots.

As with all Buhr Specials, fixtures are completely interchangeable, hydraulic and electrical installations to J.I.C. Standards, tool steel laminated, hardened and ground ways. Automatic lubrication throughout Machine.

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ANN ARBOR, MICHIGAN

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HIGH PRODUCTION MACHINERY

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at 2000 blows a minute!

The new CP Universal Electric Impact Wrench hits a new high in power and performance. Its powerful impact action develops 2000 blows a minute to run nuts or screws . . . or tap faster and easier than any other electric wrench in its class! Designed with a narrow 2″ diameter nose for getting into real tight spots, the CP-903R is rated at ⅜″ bolt size capacity but in most cases has an extra bonus capacity rating of ⅝″.

Simple, one-hand operation is afforded by its exactly centered pistol grip and reverse switch in the handle. And the reverse switch interlock prevents reversing while wrench is running. Other important features are its "unitized" motor, which assures long, maintenance-free service life plus resistance against vibration. For more information, write, *Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, N. Y.*

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On products mentioned in the editorial pages
On products shown in the advertisements

NEW CATALOGUES

STEEL CASTING MANUFACTURE—Lebanon Steel Foundry, 110 Lehman St., Lebanon, Pa. 32-page booklet describing Circle-L steel casting manufacture at the Lebanon Steel Foundry—from the design and engineering phase to final applications. Seventy photographs illustrate the entire process and show the use of Circle-L castings in diverse industries. This booklet may be obtained by writing on a company letterhead direct to William H. Worrilow, Jr., general sales manager, at the address given above.

TAPER THREAD GAGES—Sheffield Corporation, Dayton, Ohio. 58-page booklet entitled "Simplified Taper Thread Inspection with Sheffield Direct-Reading Ramp Gages," covering the use and care of male and female ramp gages for the critical analysis of compressed gas cylinders and fittings. The gages can be used to inspect taper, pitch diameter, crest truncation, root truncation, and maximum bore size. Following a general description, detailed information is given on operation, setting, and care and preservation of gages. The last section contains helpful data and tables. . . . **1**

TUNGSTEN ARC-WELDING—Air Reduction Sales Co., New York City. Catalogue ADC-709B, 15 pages covering in detail the features of the Heliwelding process—Airco's tungsten arc-welding process which uses an inert-gas shield of helium or argon, or both, to protect the weld from contamination by the atmosphere. The equipment used is described, an explanation being given as to the type of work for which it is best suited. **2**

MAGNETOSTRICTION — International Nickel Co., Inc., New York City. Bulletin A-169, consisting of a 28-page report on ferromagnetic metals and alloys in which data are given on some of their magnetostrictive properties. "Magnetostriction" is defined as the change in dimensions of a ferromagnetic material when it is placed in a magnetic field. An extensive bibliography is included on this subject. **3**

PRECISION SCREW MACHINE PRODUCTS—New Britain Machine Co., New Britain, Conn. Booklet describing the production facilities of the Precision Products Division of the company, and showing typical screw machine parts that are made by the Division, such as bolts, manifold couplings, valve rocker shafts, and push-rod adapters, from the simplest commercial pieces to the most complex aircraft components. **4**

OPTICAL TOOLING—Perkin-Elmer Corporation, Norwalk, Conn. Folder descriptive of the Model 11 machine tool microscope for quickly locating a workpiece on a table, locating holes and contours for machining, and inspecting the machined work-piece. Also featured is the new Perkin-Elmer angle comparator, a precision optical instrument for measuring surface flatness, parallelism between two surfaces, taper angles, and variations in a taper. **5**

AUTOMATIC LATHES—Sundstrand Machine Tool Co., Rockford, Ill. 32-page booklet entitled "Sundstrand Engineered Production Service for Small Lots, Long Runs, and Special Turning Jobs." Numerous examples of the company's service for obtaining higher production and lower turning cost with Sundstrand automatic lathes are provided. Practical tips on tool setting are also given. **6**

FLUOROTHENE RESINS—Bakelite Company, a Division of Union Carbide and Carbon Corporation, New York City. 16-page booklet on fluorothene resins—properties, forms, and fabrication—presenting a digest of the latest information about these resins by means of graphs, tables, and text. Recommendations on extrusion, and injection and compression molding of Bakelite fluorothene resins are included. **7**

CLEEREMAN DRILLING MACHINES—Bryant Machinery & Engineering Co., Chicago, Ill. Catalogue 600, giving comprehensive information on the features of the Cleereman round column drilling machine and box column drilling machine. Details of design and construction, as well as operating facilities and control of these heavy-duty machines, are considered. **8**

BROACH SHARPENERS—Colonial Broach Co., Detroit, Mich. Bulletin S-54, pointing out various design features of Colonial broach sharpeners for round and flat broaches and universal broach sharpening. This sharpener series, it is said, was designed for the specific job of restoring the original tooth form and effectiveness at minimum cost. **9**

TURRET LATHES—Cosa Corporation, New York City. Bulletin Pirofa 45, describing the Pittler drum type turret lathe with hand-operated three-jaw chuck and automatic cycle speed selector mechanism. Details of construction and special equipment are considered, and samples of work-pieces handled by this lathe are illustrated diagrammatically. **10**

PRECISION INVESTMENT CASTINGS—Hitchiner Mfg. Co., Inc., Milford, N. H. Bulletin 154, entitled "Investment . . . for Economy . . . for Performance," telling the advantages and limitations of precision investment casting, and showing the company's facilities for producing both ferrous and non-ferrous castings to customer specifications. **11**

PRECISION TOOLS—Erickson Tool Co., Cleveland, Ohio. Catalogue K, containing 34 pages of information on the company's tools—chucks, holders, mandrels, air cylinders, speed indexers, cutting

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bars, and special holding fixtures. Included are data on recommended uses and possible production savings, as well as machining hints. **12**

COLD-ROLLED SPECIAL-PURPOSE STEELS—Crucible Steel Co. of America, Pittsburgh, Pa. Booklet TM9, containing 31 pages of technical information on the company's line of cold-rolled specialties, including stainless, alloy, and carbon spring steels. Data are given on hardness conversion numbers, decimal equivalents, and weight-size tables. **13**

DOUBLE-CRANK STRAIGHT-SIDE PRESSES—Ferracute Machine Co., Bridgeton, N. J. General specifications for double-crank straight-side presses having crankshafts ranging from 5 to 9 inches in diameter, described in 8-page catalogue. Construction details and information pertaining to standard and special equipment are provided. **14**

CENTRIFUGAL PUMPS—Ingersoll-Rand Co., New York City. Form 7287, an instructive booklet entitled "Centrifugal Pump Fundamentals." It explains the principles of operation, illustrating them with diagrams, defines the various terms used in pump calculations, and works out typical pump problems. **15**

COUNTERBORES—Continental Tool Works Division of Ex-Cell-O Corporation, Detroit, Mich. Bulletin 60446, giving complete information on Continental standard, hand-detachable counterbore cutters. The booklet describes and shows sizes of holders, counterbores, countersinks, and pilots, as well as counterbore sets. **16**

HYDRO-PNEUMATIC BOOSTERS—Sciaky Bros., Inc., Chicago, Ill. Bulletin 322-10, covering Sciaky hydro-pneumatic boosters designed for operation with water, although they can be used with oil or non-flammable hydraulic fluids. The retraction stroke of the booster is accomplished with air pressure. . . . **17**

SET-SCREWS—Set Screw & Mfg. Co., Bartlett, Ill. Catalogue 19, containing 24 pages of descriptions and prices on conventional Setko set-screws and special types to meet difficult situations, such as Nu-Cup and Zip-Grip. There is a reference section on general screw thread data. **18**

CORRECTING VIBRATION—International Research & Development Corporation, Columbus, Ohio. 16-page booklet entitled "Balance—Final Dimension of Precision," considering the subject of vibration problems and how IRD portable vibration analyzers can eliminate unwanted vibration wherever it occurs in rotating parts. **19**

HOBS—Brad Foote Gear Works, Inc. Catalogue listing over 2000 cutters, broaches, and special tools available from the company for making a wide variety of gears, splines, and racks. These tools provide a stock which makes it possible to do most gear cutting without waiting for new tools to be made. **20**

MEASURING INSTRUMENTS—Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa. Bulletin 4210, featuring a portable extensometer comparator, which is an instrument for calibrating extensometers, compressometers, dial gages, and similar devices. The Microformer principle of measurement and method of calibration are described. **21**

PRECISION CYLINDRICAL GRINDERS—Landis Tool Co., Waynesboro, Pa. 28-page catalogue descriptive of Landis standard grinding machines and special-purpose grinding machines. Illustrated are universal, plain, roll, centerless, and special-purpose grinders for cranks, cams, pistons, valves, and similar parts. Specifications for each machine are given. **22**

HAND-LEVER PUNCH AND SHEAR—Niagara Machine & Tools Works, Buffalo, N. Y. Bulletin 79-B, concisely describing the new Niagara No. 5-24 deep-throat, hand-lever punch and shear. Action photographs demonstrate the performance of the machine in punching, notching, and shearing operations. **23**

ALUMINUM HEAT EXCHANGERS—Aluminum Company of America, Pittsburgh, Pa. 24-page booklet covering the economics in using Alcoa heat exchanger tubes, types of tubes, and an explanation of the corrosion protection provided by cladding. Applications in various industries are illustrated. **24**

METAL-WORKING MACHINES—O'Neil-Irwin Mfg. Co., Lake City, Minn. Catalogue D-SC, explaining how Di-Acro hand- and power-operated precision metal-working machines—benders, brakes, notchers, punch presses, rod parters, rollers, and shears—economically duplicate parts to die accuracy. . . . **25**

HYDRAULIC VALVES—Rivett Lathe & Grinder, Inc., Boston, Mass. Catalogue 260, featuring a new line of Rivett subplate mounted, solenoid-operated hydraulic valves. Diagrams show flow operations under all types of action for the fourteen piston designs in which the valve is offered. **26**

MARKING AND CUT-OFF TOOL—New Method Steel Stamps, Inc., Detroit, Mich. Bulletin 700-54, featuring a dual-purpose marking and cut-off tool, Model 700, that performs both marking and cut-off operations from one machine station. A typical application on a Brown & Sharpe Automatic screw machine is shown. **27**

METAL HEAT-TREATING—Jones & Laughlin Steel Corporation, Pittsburgh, Pa. Booklet entitled "Electreat," describing the J&L method of heat-treating cold finished steel bars, utilizing an electric induction heating and quenching machine. The Electreat process is explained. **28**

STUD WELDING—Nelson Stud Welding, Division of Gregory Industries, Inc., Lorain, Ohio. Catalogue D-2, entitled "How to Design for Nelwelding," explaining the Nelweld method of fastening to steel. Also, wall chart No. 1, describing types of standard MG studs and special-purpose studs. **29**

TURRET DRILLS—Burg Tool Mfg. Co., Los Angeles, Calif. Booklet descriptive of Burgmaster automatic hydraulic turret drills available in six-spindle and eight-spindle models; also of a manually operated six-spindle model. It contains operating instructions and information on accessories as well. **30**

PUNCHES AND DIES—F. J. Stokes Machine Co., Philadelphia, Pa. Bulletin 615, entitled "Some Things You Should Know About Punches and Dies," containing in-

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formation to aid in the selection of Stokes punches and dies, which are made in more than fifteen materials, including carbides. **31**

DIE-CASTINGS—Precision Castings Co., Inc., Fayetteville, N. Y. 24-page booklet entitled "Die Castings . . . Unlimited," containing over 75 pictures, drawings, and charts graphically explaining the die-casting processes, as well as the company's facilities for producing die-castings of aluminum, magnesium, and zinc. **32**

HONING MACHINES—Sunnen Products Co., St. Louis, Mo. Booklet showing the working principle of Sunnen honing and telling how it differs from other metal-working methods. Typical parts honed on Sunnen machines are concisely described and illustrated. **33**

HYDRAULIC COMPONENTS—Hydraulic Press Mfg. Co., Mount Gilead, Ohio. 28-page condensed catalogue No. 1101, covering H-P-M air and oil hydraulic components. Four sections make up the catalogue—pumps, motors, and power units; cylinders; valves; and hydraulic circuit cylinders. **34**

DIE TRY-OUT PRESSES—Dake Engine Co., Grand Haven, Mich. Bulletin 330, covering die try-out presses and describing how they can substantially reduce die production costs. The Dake presses are available in nine models having capacities ranging from 25 to 300 tons, with or without die cushions. **35**

UNIVERSAL OSCILLATING GRINDER—Gear Grinding Machine Co., Detroit, Mich. Catalogue giving details on the Geargrind universal oscillating grinder for finishing spherical and cylindrical surfaces, and indicating, by means of twelve drawings, types of work that it can perform. **36**

SPADE AND CORE DRILLS—Gairing Tool Co., Detroit, Mich. Bulletin descriptive of Conner type spade and core drills, showing a range of drilling and boring tools for use on machines generally available in most machine shops. Deep-hole drilling and boring are explained. . . **37**

CAST STAINLESS ALLOYS—Cooper Alloy Foundry Co., Hillside, N. J. Technical booklet consisting of eleven reference sheets covering the major stainless alloys cast by the company, giving chemical composition, mechanical and physical properties, machinability, heat-treatment, and other data. **38**

OIL RECOVERY UNIT—Detroit Harvester Co., Pioneer Pump Division, Detroit, Mich. Bulletin KS-54, descriptive of the Kleer Stream automatic oil recovery unit designed for use with parts washers, coolant sumps, and reservoirs handling liquids which contain oil. **39**

DUCTILE CAST IRON—International Nickel Co., Inc., New York City. Bulletin DI-1, describing a family of irons which possesses the process advantages of cast iron and has engineering properties approaching those of cast steel. The material is called ductile cast iron. . . . **40**

DIAL GAGES—Boice Mfg. Co., Inc. Staatsburg, N. Y. Bulletin 354, covering the company's dial bore gages and dial snap gages, and their matching Setmasters; Bulletin 454, on large-diameter gages, length gages, and adjustable Setmasters. **41**

AIR CONTROL VALVE—Valvair Corporation, Akron, Ohio. Bulletin SKJ-54, on the Speed King solenoid pilot-operated control valve, designed and built to meet the requirements set by J.I.C. for accessory equipment of the push-button machine. **42**

FILTERS—Cuno Engineering Corporation, Meriden, Conn. Catalogue AK-050, describing the principle, construction, and operation of Cuno industrial Auto-Klean filters, and giving case studies indicating the range of service for these filters **43**

WORM-GEAR SPEED REDUCERS—D. O. James Gear Mfg. Co., Chicago, Ill. Catalogue 45-F, on the company's Type "S" worm-gear speed reducers, giving rating tables and dimensions. Flexible couplings particularly adaptable to these reducers are listed. **44**

SAW BLADE SELECTOR—Victor Saw Works, Inc., Middletown, N. Y. Wall chart entitled "Use the Right Blade for Every Job," giving three tables to simplify blade selection for hand hacksaws, power hacksaws, and hand saws; and telling how to cure common troubles. **45**

MICROMETERS—George Scherr Co., Inc., New York City. Pamphlet describing and illustrating Scherr micrometers. All micrometers up to the 3-inch size read in 0.0001 inch. A price list is included, both for the micrometers and for Scherr Ultra-Chex gage-blocks. **46**

HYDRAULIC SURFACE GRINDERS—Thompson Grinder Co., Springfield, Ohio. Catalogue C-53, presenting complete details on Thompson Type C hydraulic surface grinders, including a diagram of controls and illustrations of auxiliary equipment. **47**

BATTERY CHARGERS—Lincoln Electric Co., Cleveland, Ohio. Catalogue 1338, which introduces the company's line of battery chargers for heavy-duty trucks, three models being available to cover charging requirements for batteries of 10 to 42 cells. **48**

AIR GAGES—Taft-Peirce Mfg. Co., Woonsocket, R. I. Catalogue 613, consisting of 28 pages of descriptive infor-

(Continued on next page)

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mation on various types of CompAIRator units, as well as illustrating many inspection problems solved by air gaging. . . **49**

DRILLING AND TAPPING MACHINE—Edlund Machinery Co., Cortland, N. Y. Bulletin G-54, covering six types of Edlund drilling and tapping machines for multiple-purpose service, and explaining the various features of each. **50**

OPTICAL GAGING—Optical Gaging Products, Inc., Rochester, N. Y. Folder explaining the "dual image" principle of two simultaneous images on a contour projector screen, and featuring a universal shaft checking fixture designed for inspecting shafts by optical gaging. **51**

NICKEL-ALUMINUM BRONZE—International Nickel Co., Inc., New York City. Bulletin A-133, giving composition and mechanical properties of nickel-aluminum bronzes, and illustrating their applications in various industries. . . **52**

WELDING FLUXES—Lincoln Electric Co., Cleveland, Ohio. Reprint entitled "New Development in Fluxes for Automatic Welding and Hard Surfacing," describing the use of agglomerated fluxes in automatic welding. **53**

FLOATING HOLDERS—Scully-Jones & Co., Chicago, Ill. Catalogue on the new Scully-Jones floating holders of "JT" lock and eject collet type. These holders are designed with separate floating and driving elements. **54**

COMPRESSION RIVETER—Keller Tool Co., Grand Haven, Mich. Catalogue Section 50, describing a pneumatic riveter designed for riveting, forming, punching, and similar operations. The riveter features a controlled squeeze. **55**

GAGE SELECTOR—Sheffield Corporation, Dayton, Ohio. Slide-rule gage selector for the convenient selection of proper pitch diameters for all American or Unified thread plug or thread ring gages. ... **56**

CLUTCH-COUPLING UNITS—Formsprag Co., Van Dyke, Mich. Folder on the new line of Formsprag clutch coupling units, giving a service factor table, dimensional data, and a typical clutch-coupling work sheet. **57**

WIPER RING SEAL—Hydraulic Accessories Co., Van Dyke, Mich. Leaflet descriptive of Seal-Guard metallic rod wipers for protecting hydraulic packings from sand, grit, and other foreign materials. **58**

HEAT-TREATING—Leeds & Northup Co., Philadelphia, Pa. Catalogue TD2-625, 20 pages describing five kinds of L & N Homo furnaces and the jobs they are built to do for production tempering of either dense or open loads. **59**

TAPPING MACHINES—Fox Engineering Co., Jackson, Mich. Circular F-1994, descriptive of three models of Fox tapping machines. These multiple-spindle machines are equipped with lead-screw type tapping units. **60**

COATED ABRASIVES—Clover Mfg. Co., Norwalk, Conn. 36-page revised booklet, containing technical information on coated abrasives—materials, methods of manufacture, and uses. A list of trade names is included. **61**

REBUILT MACHINE TOOLS—Miles Machinery Co., Saginaw, Mich. Catalogue 198, containing 36 pages of descriptive information on available rebuilt machine tools, most of them located in the Saginaw warehouse. **62**

SELF-LOCKING SPRING PINS—Standard Pressed Steel Co., Jenkintown, Pa. Folder explaining the use of Sel-Lok spring pins and giving typical applications of these self-locking fasteners. **63**

HARDENED AND GROUND PARTS—Orange Roller Bearing Co., Inc., Orange, N. J. Booklet outlining the company's facilities for producing machined, hardened, and ground parts to specifications. Typical parts are shown. **64**

STOCK AND DRILL STOPS—Wohlnip Engineering Co., Hillside, N. J. Leaflets on revolving stock stops for turret lathes and automatic screw machines; and nonrotating drill stops for "hole depth control." **65**

LEAD-SCREW TAPPING ATTACHMENT—Automatic Methods, Inc., Elizabeth, N. J. Bulletin 201, descriptive of the "Auto-tap" lead-screw tapping attachment for use on any 14- to 20-inch drill press. Specifications are given. **66**

JIG AND FIXTURE COMPONENTS—Lodding, Inc., Worcester, Mass. 86-page catalogue, describing and illustrating the company's expanded line of standard jig and fixture components. **67**

RING GAGES—Size Control Co., Chicago, Ill. Folder descriptive of "Boremaster" ring gages designed especially for setting dial bores and other types of inside measuring devices. **68**

STEEL PLATES—Lukens Steel Co., Coatesville, Pa. Information folder, giving data on available sizes, thicknesses, and weights for Lukens carbon, alloy, and clad steel plate. **69**

POWER HACKSAWS—Sales Service Machine Tool Co., St. Paul, Minn. Combination specification and price sheet for ten models in the Keller power hacksaw line. **70**

GEAR-MOTORS—D. O. James Gear Mfg. Co., Chicago, Ill. Supplement catalogue 47-C, outlining features of the company's gear-motor. **71**

PLEASE SEND US MORE INFORMATION. Circle below item numbers on which you wish further information.

1	2	3	4	5	6	7	8	9	10	11	12	13	14
15	16	17	18	19	20	21	22	23	24	25	26	27	28
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For more details on products mentioned in July editorial or advertising pages, fill in below:

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This card is void after October 1, 1954 **M-7/54**

PLEASE SEND US MORE INFORMATION. Circle below item numbers on which you wish further information.

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For more details on products mentioned in July editorial or advertising pages, fill in below:

PAGE ..... **PRODUCT** .....

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NAME .....

TITLE .....

COMPANY .....

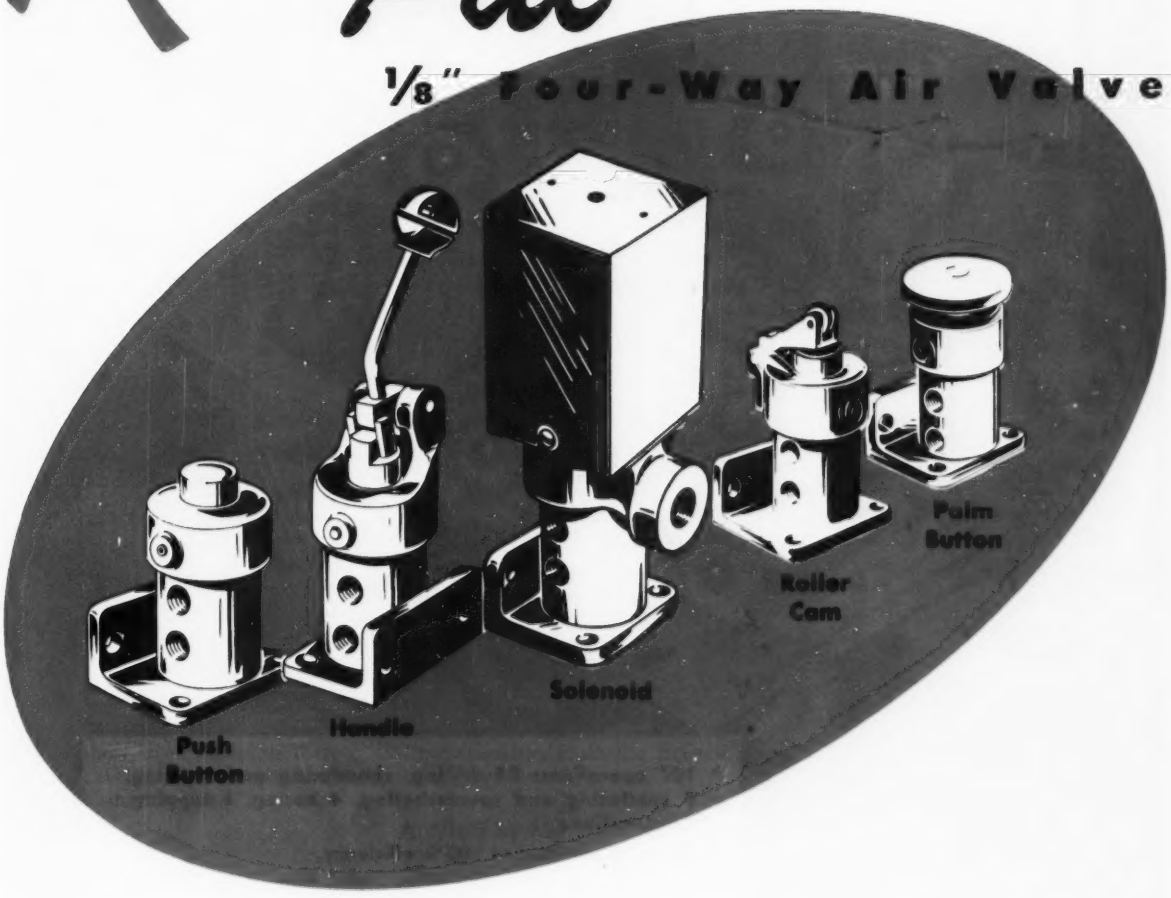
CO. ADDRESS .....

CITY ..... **ZONE** ..... **STATE** .....

This card is void after October 1, 1954 **M-7/54**

Ross Pal

1/8" Four-Way Air Valve



- *Hand-Solenoid-Cam*
- *One Moving Part*
- *Heads Interchangeable*
- *May be Used as a Two-Way or Three-Way, Normally Open or Normally Closed*
- *Write Dept. 110 for Bulletin 309A*

Tomorrow's EnginAIRing Delivered Today

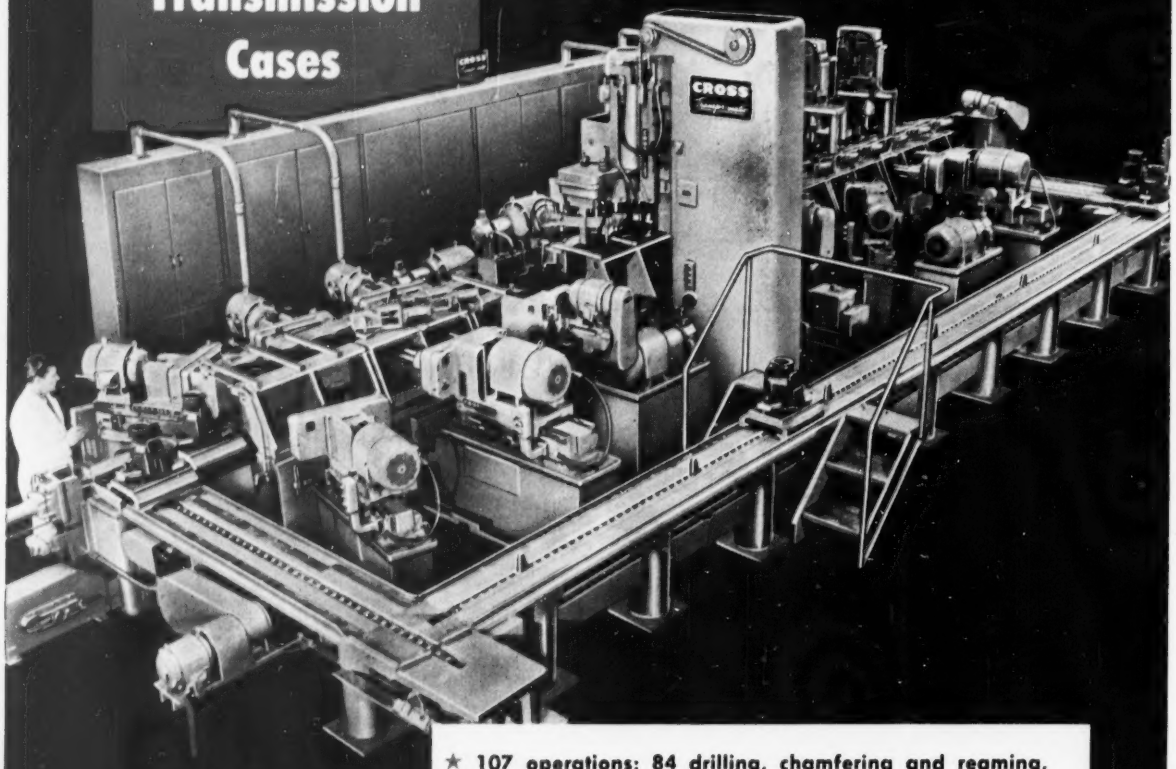
ROSS Control VALVES

Ross OPERATING VALVE COMPANY

120 E. GOLDEN GATE AVENUE • DETROIT 3 • MICHIGAN

Drills, Bores, Reams and Taps Transmission Cases

Another Transfer-matic by Cross



- ★ 107 operations: 84 drilling, chamfering and reaming, 8 spotfacing and counterboring, 4 boring, 6 tapping, 5 inspection.
- ★ 95 parts per hour at 100% efficiency.
- ★ 21 stations: 1 for loading, 1 for unloading, 15 for machining, 4 idle.
- ★ Machine stops automatically if critical tools are broken or improperly set for depth.
- ★ Pallet type work holding fixtures with automatic transfer from station to station and integral conveyor for automatic moving from unloading to loading station.
- ★ Complete interchangeability of all standard and special parts for easy maintenance.
- ★ Other features: Hardened and ground ways, built-in chip conveyors, hydraulic feed and rapid traverse, individual lead screw feed for tapping, automatic lubrication and J.I.C. construction.

Established 1898

THE CROSS CO.

DETROIT 7, MICHIGAN

Special MACHINE TOOLS

For more information on products advertised, use Inquiry Card, page 265

Between Grinds

By E. S. Salichs

Content!

The Table of Contents page of MACHINERY is being reproduced monthly in photostat form and distributed widely at the Arnold Engineering Development Center. According to Aro, Inc., which is responsible for providing technical information service to the Center, any of the personnel scanning the page and interested particularly in certain articles can call for quick delivery of the magazine. The magazine was previously routed, but slowly, down the line.

The Attraction of Action

Visitors to exhibitions in the industry, such as the recent Metal Show, spend most of their time in booths where products are working, moving, and performing.

Slippery When Wet

Smooth, dangerous areas of highways are being treated experimentally in New York State with "Highway Safety Grain," a product of The Carborundum Company, with the help of cooperating Firestone engineers. This fused alumina abrasive material, when impregnated in the road surface, provides good tire traction. By testing critical curves, it has been estimated that only two-thirds the distance is required to stop a car traveling at 30 miles an hour on a wet asphalt-top highway so treated.

Precisely

In some places, such as Manila, the jeep is being used as a taxi and so a word has been coined for it—*jeepney*. This led us to investigate *jitney*, which is possibly derived, according to the dictionary, from the French verb, *jeter*—to throw.

A Whiff by Biff

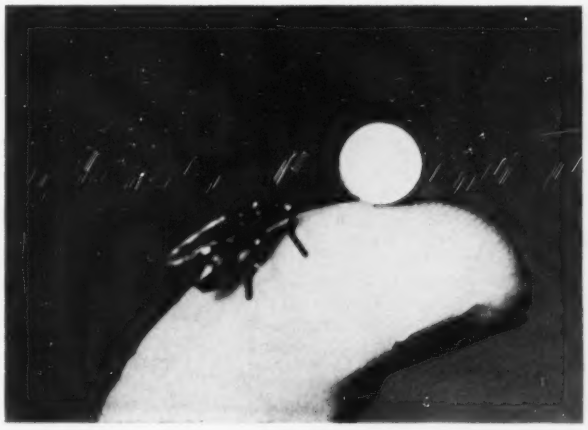
An oil-well fire in Oklahoma that had been burning for forty hours, $40,000 damage, was put out in five seconds by using about 10 pounds of Ansul dry powder from a hand extinguisher. The man called in to extinguish this stubborn blaze was Biff Hansen, fire chief at the Continental Oil Refinery, who had been trained at the Ansul Chemical Co.'s Customer Fire School in Kansas City.

Now Hear This

Electric fork lift trucks dispatched from a central control office at Chrysler's Indianapolis plant are equipped with two-way, short-wave radio-telephone sets, in order to expedite materials handling.

Bitter About Breakfast?

The micro-hardness testing of such things as carbide steels, atomic by-products, plastic laminating resins—and sausage skins—was discussed recently by V. E. Lysaght, sales manager of the Wilson Mechanical Instrument Division, American Chain & Cable Co., before a convention of the American Society for Quality Control.



THE POWER OF THE PILL—Is the fly poised on a man's thumb studying the possibility of nibbling on a pellet? No, this strange assembly was photographed to show the size of a General Electric rectifier. Made of selenium, these aspirin-size rectifiers are used to convert alternating to direct current in industrial equipment and intricate computing machines. Before being installed, they are placed in compact stacks and enclosed in glass, metal, or plastic tubes.

News OF THE INDUSTRY

California, Washington, and Texas

INDUSTRIAL TOOL & SUPPLY CO., San Jose, Calif., has been named a distributor by the CARBOLOY DEPARTMENT OF GENERAL ELECTRIC CO., Detroit, Mich. The concern will carry the Department's line of standard cemented carbide tools and blanks, carbide-tipped masonry drills, and diamond wheel dressers.

VAS PEICKII has been appointed factory manager of the Los Angeles, Calif., plant of the Micromatic Hone Corporation, Detroit, Mich. Mr. Peickii is a former partner of the M. E. Engineering Co., Los Angeles, which was purchased by Micromatic.

LOREN B. CLAY has been appointed manager of a new department at the Seattle, Wash., steel service plant of Joseph T. Ryerson & Son, Inc., Chicago, Ill. This department will specialize in the sale of tubular products and cold-finished steel bars. Mr. Clay has been with the Ryerson organization for fourteen years.

CHICAGO PNEUMATIC TOOL CO., New York City, announces that its recently completed $4,500,000 plant in Fort Worth, Tex., is now in full production on a complete line of oil-well drilling equipment for the petroleum industry. The plant occupies 130,500 square feet of floor space.

Connecticut

CUNO ENGINEERING CORPORATION, Meriden, Conn., has appointed JAMES A. PLUMMER & Co., industrial sales representative for the Middle Atlantic States. JAMES A. PLUMMER was with Cuno for twelve years in various executive capacities, including general sales manager. Associated with him will be ARTHUR T. LAWLEY, who also was with Cuno, having been in the Philadelphia area for six years.

STANLEY W. LOVEJOY has joined Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn., to head the cutting tool research laboratory. With the title of manager, cutting tool research, his duties will include basic research, development, and testing of products manufactured in the company's Cutting Tool Division. He comes to P & W from the General Electric Co., where he was the tool supervisor of the West Lynn Works and a consultant on cutting tool and design application.

Stanley W. Lovejoy heads cutting tool research at Pratt & Whitney Division Niles-Bement-Pond Co.

JACOB J. JAEGER has been appointed to the newly created post of chief engineer, machinery engineering department, of Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn. Mr. Jaeger became associated with Pratt & Whitney in 1940 as a research engineer and was made assistant manager of machinery engineering in 1951.

Jacob J. Jaeger, chief engineer, machinery engineering department, for Pratt & Whitney

FARMINGTON ENGINEERING CO. has moved to its new and larger plant at 72 Granby St., Bloomington, Conn. The company manufactures plug, ring, and other types of gages.

Illinois and Indiana

L. H. REMIKER, chief engineer of the Lindberg Engineering Co., Chicago, Ill., for the last nineteen years, will become head of the company's newly formed Field-erected Equipment Division. E. B. JONES has joined the concern as chief engineer in charge of estimating and engineering in this Division.

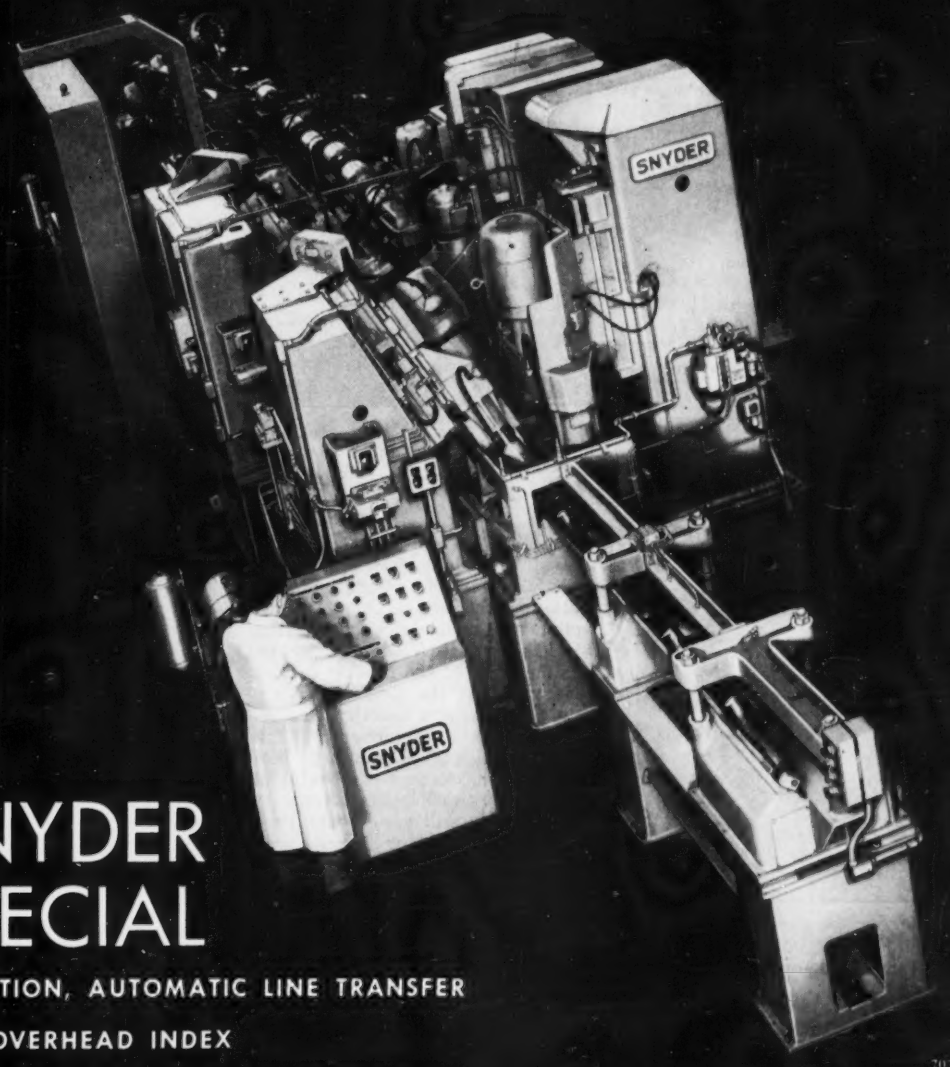
CARL C. GROTNES, president of the Grotnes Machine Works, Inc., Chicago, Ill., is retiring after more than forty years of service. He was a pioneer in the design of machinery used in the manufacture of automobile, truck, and agricultural rims, as well as steel containers.

HERBERT HARIG, who is vice-president of the Harig Mfg. Corporation, Chicago, Ill., has been elected secretary of the National Tool & Die Manufacturers Association. He succeeds the late Albert Goldman.

ATŌMIC DIE CASTING CORPORATION is a new die-casting concern organized by HENRY A. and WILLIAM J. KLEIFGEN. The firm is located at 7817 S. Claremont Ave., Chicago 20, Ill.

B. L. OWENS, director of marketing, has been advanced to sales manager of the Atkins Saw Division, Borg-Warner Corporation, Indianapolis, Ind. Mr. Owens has been connected with Atkins for thirty-two years. Other appointments announced are as follows: M. A. BAUER, assistant sales manager; and M. A. STRAUB, assistant sales manager in charge of advertising and sales promotion.

WILLIAM D. REED has been appointed works manager of the Midwest Division of the H. & B. American Machine Co., Inc., Indianapolis,



SNYDER SPECIAL

17-STATION, AUTOMATIC LINE TRANSFER
WITH OVERHEAD INDEX
MILLS, DRILLS, CORE-DRILLS, SPOT-FACES
REAMS AND TAPS
320 EXHAUST MANIFOLDS AN HOUR
AT 80% EFFICIENCY

SNYDER

TOOL & ENGINEERING COMPANY
3400 E. Lafayette, Detroit 7, Michigan
29 Years of Successful Cooperation with Leading American Industries

Ind. Mr. Reed, who will have his headquarters in Indianapolis, was formerly superintendent of fabrication at the Convair Division of General Dyamics Corporation, San Diego, Calif.

NOLAN E. MCDONALD has joined the Magnesium Co. of America, East Chicago, Ind., and will head the new impact extrusion department.

Massachusetts

PAUL W. POLK was recently elected president of the Threadwell Tap & Die Co., Greenfield, Mass., a subsidiary of the Sheffield Corporation, Dayton, Ohio. Other officers are LOUIS F. POLK, chairman and treasurer; JOHN P. BERNARD, vice-president; R. F. WHISLER, vice-president and assistant treasurer; and EDWARD T. NOE, JR., secretary. The Threadwell concern manufactures taps, dies, keyway cutters, gages, and other precision products.

Paul W. Polk, president of the Threadwell Tap & Die Co.

REID BROTHERS CO., INC., Beverly, Mass., manufacturer of surface grinders, announces the appointment of the folowing distributors: FUCHS MACHINERY & SUPPLY CO., 2401 N. 11th St., Omaha, Nebr.; and GROSS MACHINERY CO., LTD., 18-24 Jarvis St., Toronto, Ontario, Canada.

ROBERT L. FIELDING was recently elected president and treasurer of the Commercial Filters Corporation, Melrose, Mass.

Michigan

PHILIP H. EMRICH has been named manager of the Joplin, Mo., manufacturing plant of Vickers, Inc., Detroit, Mich. He will direct all activities at this plant, which manufactures oil hydraulic pumps and controls for the aircraft and mobile equipment industries. Mr. Emrich, who has been with Vickers since 1942, was manager of the product service department at the time of his appointment. GORDON ELLIOTT, who supervised plant construction and initial production at Joplin, will now return to his former post as plant manager at Omaha, Nebr. GREGORY M. MCKEOWN will assume the position formerly held by Mr. Emrich, his headquarters being in Detroit. He was formerly supervisor of product improvement. GEORGE C. BONNELL will be assistant head of the product service department.

Philip H. Emrich, manager of the Joplin, Mo., plant of Vickers, Inc.

BUHR MACHINE TOOL CO., Ann Arbor, Mich., has announced the appointment of four agents: ELLFELDT MACHINERY & SUPPLY CO., Kansas City, Mo., for Kansas, Oklahoma, and western Missouri; INTERSTATE MACHINERY & SUPPLY CO., Omaha, Nebr., for Nebraska and western Iowa; GIEBEL, INC., New York City, for eastern New York State, Connecticut, and northern New Jersey; and TOOL ENGINEERING SERVICE, Birmingham, Ala., to represent Buhr in Florida, Georgia, Tennessee, Alabama, and northern Mississippi.

ROBERT C. LOHBAUER has joined the sales engineering staff of the Snyder Tool & Engineering Co., Detroit, Mich., designer and builder of special machine tools. Mr. Lohbauer started his career in the special machine field nearly thirty years ago. He was formerly with the Dana Corporation, Toledo, Ohio, most recently having been assistant to the director of manufacturing.

JOHN W. MASON, sales engineer for the Allen-Bradley Co., Milwaukee, Wis., electrical control manufacturer, has been appointed district manager of the Detroit, Mich., office, succeeding J. D. PETERSEN, who has retired. Mr. Mason has been affiliated with the company as a sales engineer since 1952, prior to that having been with the Raub Supply Co. as supply sales manager.

ERNEST E. GEORGE, manager of design and application engineering of the Carboloy Department of General Electric Co., Detroit, Mich., has been named manager of magnetic products engineering. Mr. George joined the company in 1933 as a test engineer.

EDWARD A. FARWIG has been named chief engineer of the Buhr Machine Tool Co., Ann Arbor, Mich.

Edward A. Farwig, new chief engineer of the Buhr Machine Tool Co.

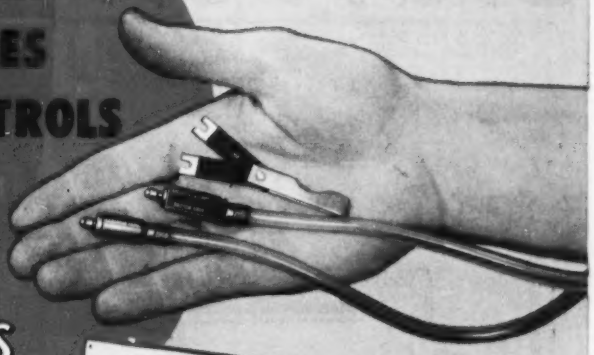
Mr. Farwig was formerly assistant to the sales manager of the company. OTTO HAISCH has assumed the position of assistant to the sales manager which was vacated by Mr. Farwig. Mr. Haisch has been engaged in sales engineering work for the last six years.

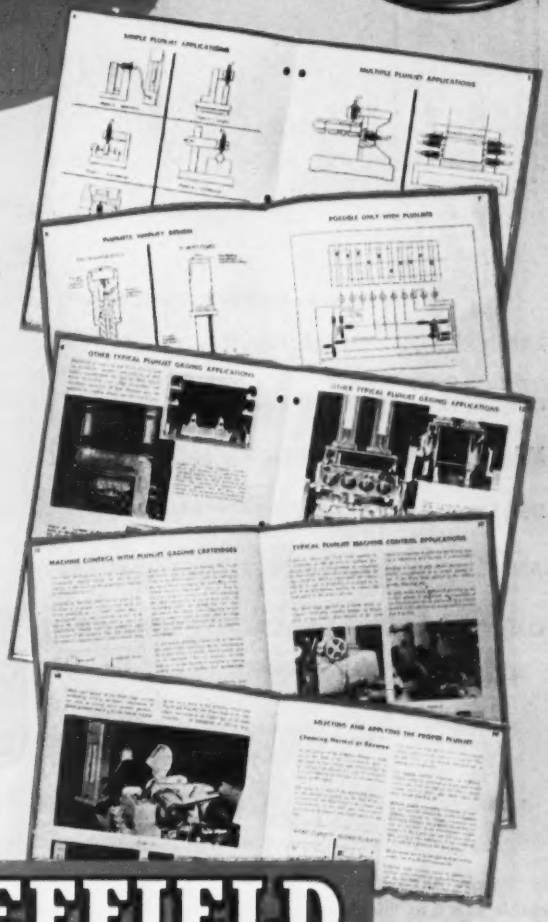
EDGAR W. ENGLE, manager of product and process development engineering, in the Carboloy Department of General Electric Co., Detroit, Mich., has been named manager of cemented carbide products engineering. Mr. Engle has been with Carboloy since 1941.

JOHN DELANEY, formerly development engineer at Lincoln Park Industries, Inc., Lincoln Park, Mich., has been made vice-president and factory manager, while ROBERT G. FIELD, who was plant manager, has been appointed sales manager and administrative assistant.

(*Continued on page* 279)

MAKE YOUR OWN GAGING FIXTURES and MACHINE CONTROLS *with* "PLUNJET" GAGING CARTRIDGES





LOW COST— HIGH ACCURACY

- Check any dimension or geometrical relationship
- Control feed of machine tools precisely
- Tolerance range .100"—.0001"
- Amplification range 62.5—5000
- Applicable with any air gage
- Bodies ⅜" square or cylindrical
- Two lengths, 1½" and 1¾"
- Only one moving part
- Immediate delivery in quantity
- Low cost

GAGE DIVISION, DEPT. 6, THE SHEFFIELD CORPORATION
DAYTON 1, OHIO, U. S. A.

MASTER CRAFTSMAN SHEFFIELD HEADQUARTERS

SHEFFIELD

6716

YOUR PLUNJET ENGINEERING DATA *FREE*

Send Me Plunjet Engineering Data

SIGNED_____ POSITION_____

COMPANY_____ STREET_____

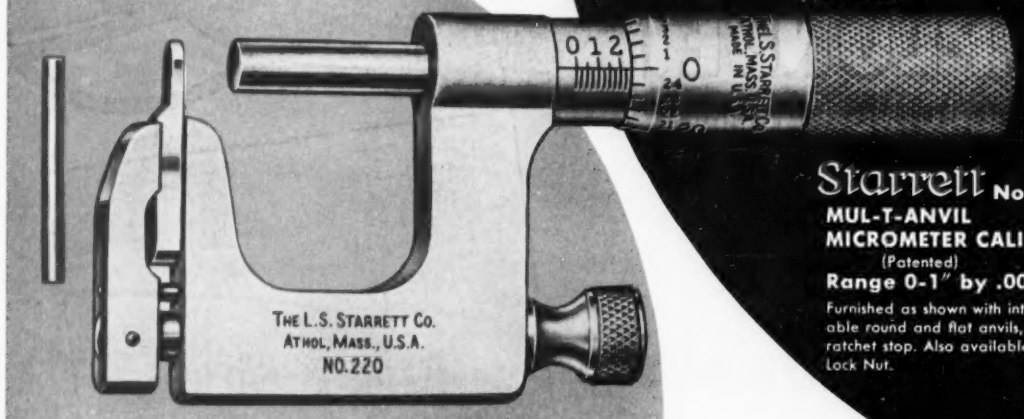
CITY_____ ZONE_____ STATE_____

Another

Starrett® first!

NEW No. 220 MUL-T-ANVIL MICROMETER CALIPER

(Patented)



Starrett No. 220
MUL-T-ANVIL
MICROMETER CALIPER
(Patented)
Range 0-1" by .001"
Furnished as shown with interchangeable round and flat anvils, without ratchet stop. Also available with Lock Nut.

REDUCES TOOL INVESTMENT

ONE MICROMETER FOR MANY USES

MEASURES WHERE OTHER MIKES WON'T

USE WITH STANDARD OR SPECIAL ANVILS

ANVILS CHANGED QUICKLY, LOCKED RIGIDLY

ONLY ONE SIMPLE LOCK SCREW ADJUSTMENT

Buy THROUGH YOUR INDUSTRIAL DISTRIBUTOR

Here is a brand new development in micrometer design . . . a micrometer with multiple interchangeable anvils created with typical Starrett ingenuity to make easy work of a wide variety of difficult measuring jobs. It permits quick, accurate measuring of tubing, cylindrical walls or work of irregular shape . . . from holes or slots to an edge . . . in places difficult or impossible to reach with an ordinary micrometer. Can also be used as height gage.

New Starrett No. 220 *MUL-T-ANVIL* Micrometer is now available as a 0 to 1 inch micrometer caliper. Ask your industrial distributor to show you this indispensable new tool . . . or write for complete information. Address Dept. D.

New Starrett No. 220 *MUL-T-ANVIL* Micrometer is furnished with two multi-purpose anvils, a round anvil and a double-ended flat anvil. It will also accept special anvils up to 5/16" thick — make your own at low cost or we will make them for you on special order. Anvils are rigidly held in a vise-type frame and quickly interchanged by a single lock screw adjustment.

Starrett®

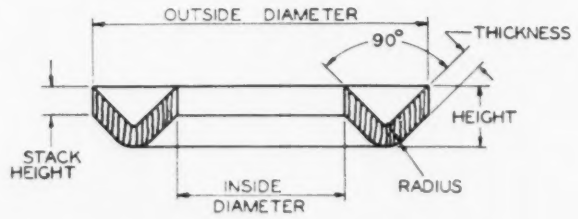
STARRETT TOOLS

"WORLD'S GREATEST TOOLMAKERS"

MECHANICS' HAND MEASURING TOOLS AND PRECISION INSTRUMENTS • DIAL INDICATORS • STEEL TAPES
PRECISION GROUND FLAT STOCK • HACKSAWS, BAND SAWS and BAND KNIVES
THE L. S. STARRETT COMPANY, ATHOL, MASSACHUSETTS, U. S. A.

For more information on products advertised, use Inquiry Card, page 265

RECOMMENDED DIMENSIONS FOR LEATHER VEE PACKINGS — 1



Recommended Number of Vee Packings per Set

Pressure, Pounds per Square Inch	0 to 500	500 to 2000	2000 to 6000	6000 to 20,000
Number of Vee Packings	3	4	5	6

Recommended Standards for Most Generally Used Vee Packings

Inside Diameter, Inches		Width of Cross-Section, Inch	Leather Thickness, Inch
Range	In Increments of		
1/4 to 1 1/4	1/16	1/4	1/16
1 3/8 to 2 1/2	1/8	5/16	5/64
2 5/8 to 3 7/8	1/8	3/8	3/32
4 to 5 1/2	1/4	7/16	3/32
5 3/4 to 11	1/4	1/2	1/8
11 1/2 to 16	1/2	5/8	1/8
16 1/2 and over	1/2	3/4	5/32

Recommended Dimensions of Vee Packings Used with Female Support Rings Having a 90-Degree Included Angle

Width of Cross-Section, Inch	Leather Thickness, Inch	Height of Packing, Inch	Stack Height, Inch	Radius of Support Rings, Inch†	Radius of Packing, Inch
3/16	3/64	0.1249	0.0661	1/16	1/16
3/16	1/16	0.1405	0.0884	5/64	5/64
13/64	3/64	0.1328	0.0649	1/16	1/16
13/64	1/16	0.1485	0.0884	5/64	5/64
7/32	3/64	0.1406	0.0661	1/16	1/16
7/32	1/16	0.1562	0.0884	5/64	5/64
15/64	3/64	0.1484	0.0649	1/16	1/16
15/64	1/16	0.1640	0.0884	5/64	5/64
1/4	3/64	0.1562	0.0661	1/16	1/16
1/4*	1/16	0.1718	0.0884	5/64	5/64

*Standard cross-sections. †Tolerances: +0.015 and −0.000 inch.

MACHINERY'S Data Sheet No. 757, July, 1954

Compiled by the American Leather Belting Association

RECOMMENDED DIMENSIONS FOR LEATHER VEE PACKINGS — 2

Width of Cross-Section, Inch	Leather Thickness, Inch	Height of Packing, Inch	Stack Height, Inch	Radius of Support Rings, Inch†	Radius of Packing, Inch
9/32	3/64	0.1718	0.0661	1/16	1/16
9/32	1/16	0.1874	0.0884	5/64	5/64
5/16	1/16	0.2030	0.0884	5/64	5/64
5/16*	5/64	0.2187	0.1104	3/32	3/32
11/32	1/16	0.2187	0.0884	5/64	5/64
11/32	5/64	0.2344	0.1105	3/32	3/32
3/8	1/16	0.2343	0.0884	5/64	5/64
3/8	5/64	0.2500	0.1105	3/32	3/32
3/8*	3/32	0.2656	0.1325	7/64	7/64
13/32	1/16	0.2499	0.0884	5/64	5/64
13/32	5/64	0.2656	0.1105	3/32	3/32
13/32	3/32	0.2812	0.1325	7/64	7/64
7/16*	3/32	0.2969	0.1325	7/64	7/64
7/16	1/8	0.3281	0.1770	9/64	9/64
15/32	3/32	0.3125	0.1325	7/64	7/64
15/32	1/8	0.3438	0.1770	9/64	9/64
1/2	3/32	0.3281	0.1325	7/64	7/64
1/2*	1/8	0.3594	0.1770	9/64	9/64
9/16	3/32	0.3593	0.1325	7/64	7/64
9/16	1/8	0.3906	0.1770	9/64	9/64
5/8*	1/8	0.4219	0.1770	9/64	9/64
5/8	5/32	0.4531	0.2209	11/64	11/64
11/16	1/8	0.4531	0.1770	9/64	9/64
11/16	5/32	0.4843	0.2209	11/64	11/64
11/16	3/16	0.5156	0.2652	13/64	13/64
3/4	1/8	0.4844	0.1770	9/64	9/64
3/4*	5/32	0.5156	0.2209	11/64	11/64
3/4	3/16	0.5469	0.2652	13/64	13/64
13/16	5/32	0.5468	0.2209	11/64	11/64
13/16	3/16	0.5781	0.2652	13/64	13/64
7/8	5/32	0.5781	0.2209	11/64	11/64
7/8	3/16	0.6094	0.2652	13/64	13/64
1	3/16	0.6719	0.2652	13/64	13/64

*Standard cross-sections. †Tolerances: +0.015 and −0.000 inch.

MACHINERY'S Data Sheet No. 758, July, 1954

Compiled by the American Leather Belting Association

FOR PRECISION IN VOLUME JET BLADE PRODUCTION . . .

EX-CELL-O

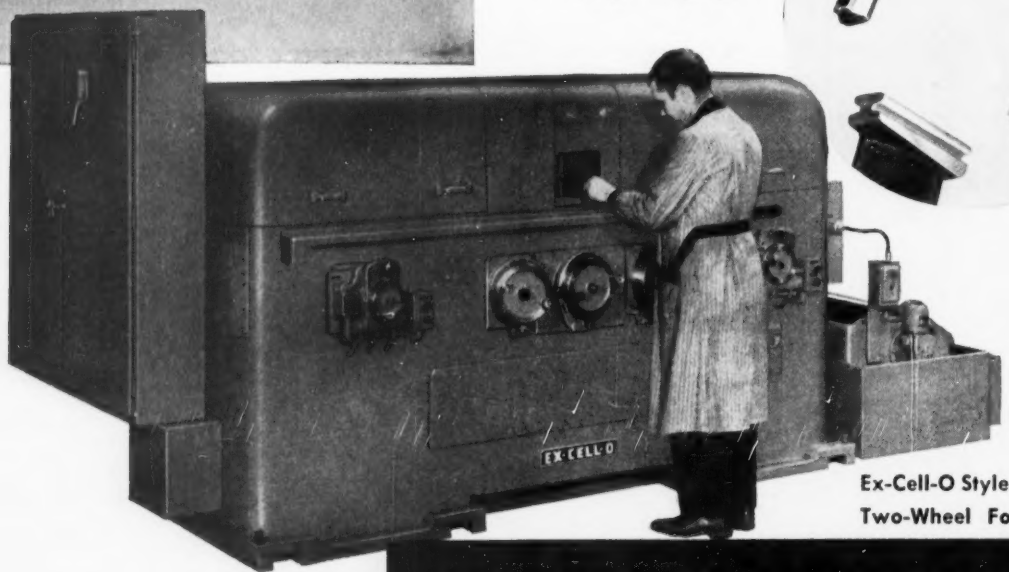
MACHINE GRINDS ROOTS OF JET BLADES AND BUCKETS

With this production-proved Style 85 Precision Two-Wheel Form Grinder both sides of the root forms of jet blades and buckets can be ground simultaneously. Automatic features permit unskilled operators to do the work quickly and accurately.

Wheel dressing and size compensation, work reciprocation, wheel feed and retraction, coolant control, unclamping, and lubrication—all these functions are automatic. Operator has only to load, unload, and press clamp and start cycle buttons.

For precision in volume jet blade production, install the "Ex-Cell-O Package" of jet blade finishing machines, including Style 86 Profile Miller, Style 87 Profile Grinder and Style 88 Profile Polisher. Write, wire, or phone Ex-Cell-O in Detroit or contact your local Ex-Cell-O representative today. Ask for Bulletin 50719.

Dovetail and pinetree forms are ground automatically from rough forgings.



Ex-Cell-O Style 85 Precision Two-Wheel Form Grinder.

EX-CELL-O CORPORATION

XLO
EX-CELL-O for PRECISION

2-20

Thomas B. Doe, Jr., newly appointed master mechanic for Vickers, Inc.

THOMAS B. DOE, JR., has been appointed master mechanic for Vickers, Inc., Detroit, Mich., manufacturer of oil-hydraulic power transmission equipment. He will be responsible for process engineering, tooling, and other activities in the Detroit, Omaha, and Joplin plants. Mr. Doe joined the company in 1938, and has been manager of aircraft products sales since 1945.

OMER E. ROBBINS CO. recently moved to its new plant at 24800 Plymouth Road, Detroit, Mich. The company produces precision equipment, including sine-plates, special jigs, fixtures, and gages.

WILLIAM C. GOECKEL, assistant sales manager of the Snyder Tool & Engineering Co., Detroit, Mich., has been promoted to the post of sales manager. Mr. Goeckel joined the Snyder organization, which designs and builds special-purpose machines, in 1947. He was in the engineering department then and later transferred to sales engineering.

William C. Goeckel, sales manager of Snyder Tool & Engineering Co.

New York and New Jersey

H. R. SALISBURY, president of the Air Reduction Sales Co., New York City, retired on June 1. He was succeeded by J. H. HUMBERSTONE, president of the Ohio Chemical & Surgical Equipment Co., a division of Airco, Madison, Wis., and also vice-president of Air Reduction Co., Inc. Mr. Salisbury will continue as a director of the foreign subsidiaries, Air Reduction Canada, Ltd., and Cuban Air Products Corporation. R. E. LENHARD, who was vice-president of the Ohio Chemical & Surgical Equipment Co., will succeed Mr. Humberstone as president of that division.

COSA CORPORATION, New York City, importer of Swiss and German machine tools, recently announced the formation of a new associated company—COSA CORPORATION OF OHIO, located at 3315 Brookpark Road, Parma, Ohio. WILLIAM JENKS will be manager. The Ohio area was formerly covered by the Detroit Cosa Corporation. This organization will now operate under another name—COSA CORPORATION OF DETROIT—and will serve eastern Michigan from a new office at 20118 James Couzens Highway, Detroit, Mich. ANTON JOEN is manager.

ROSSER L. WILSON, chief engineer of the Brake Shoe and Castings Division of the American Brake Shoe Co., New York City, has been appointed vice-president in charge of engineering. He replaces ROBERT B. POGUE who, having reached retirement age, is being retained as consulting engineer to the Division. Mr. Pogue, with Brake Shoe since 1916, was vice-president of engineering since 1949.

PRODUCTO MACHINE CO., Bridgeport, Conn., announces that its Rochester plant has moved to 1300 Mount Read Blvd., Rochester 6, N. Y. The new building will house a die set assembly plant and carry a more complete stock of die sets, die maker's accessories, and toolroom equipment. DAVID S. HODGSON, district sales manager, will be in charge.

W. A. NEUMANN has become executive vice-president and treasurer of the DeLaval Separator Co., Poughkeepsie, N. Y. He was formerly vice-president in charge of sales at the DeLaval Steam Turbine Co., Trenton, N. J., from which position he resigned to assume his new duties. H. G. BAUER will now become vice-president and general sales manager of the Trenton concern.

FRANK L. LAQUE has been elected vice-president of the International Nickel Co., Inc., New York City, and manager of its Development and Research Division. He succeeds in both positions THOMAS H. WICKENDEN, who has retired but will continue to serve the company as a consultant on special projects. O. B. J. FRASER and DONALD J. REESE will serve as assistant managers of the Division.

GEORGE J. FICKEN, JR., has been appointed assistant general sales manager of the Russell, Burdsall & Ward Bolt and Nut Co., Port Chester, N. Y. Mr. Ficken has held various sales and executive positions in the company, and was assistant office manager in the headquarters office at the time of his present appointment.

AUSTIN FORD LOGAN, INC., Buffalo, N. Y., has been named distributor for the CARBOLOY DEPARTMENT OF GENERAL ELECTRIC CO., Detroit, Mich., and will carry the Department's line of standard cemented carbide tools and blanks, carbide-tipped masonry drills, and diamond wheel dressers.

HAROLD CHRISTOPHER and ADOLPH A. HIRSTIUS have been appointed manager and assistant manager, respectively, of the Manufacturers' Products Department, American Steel and Wire Division of the United States Steel Corporation, New York City. Mr. Christopher replaces FRANK T. CLARKE, who was promoted to manager of sales in Boston.

ROBERT N. TOMB has been named manager of aircraft instrument sales in the meter and instrument department of the General Electric Co., Schenectady, N. Y. He succeeds ARTHUR G. WOODSIDE, who has assumed new duties in the department's manufacturing section.

HERMANN A. BOTTENHORN, rolling mill chief engineer of Hydropress, Inc., New York City, has been elected vice-president in charge of its Rolling Milling Division. Mr. Bottenhorn, who joined Loewy-Hydropress in 1946, has been connected with the Loewy group for thirty years.

ROY F. HANCOCK, assistant to the vice-president of sales, has been promoted to assistant vice-president of the Vanadium Corporation of America, New York City. Also announced was the appointment of FREDERICK F. FRANKLIN to assistant district manager at Cleveland, Ohio.

ROBERT L. PEAVY, JOHN C. HEBRON, and PAUL T. GRANT have been appointed contract engineering representatives of the Kollsman Instrument Corporation, Elmhurst, N. Y.

AMERICAN CAR & FOUNDRY CO., New York City, announces its corporate name has been changed to ACF INDUSTRIES, INCORPORATED.

ROBERT F. ELMIGER has been appointed sales promotion manager in the Alloy Tube Division of the Carpenter Steel Co., Union, N. J. He will also continue as market analyst for the Division, a position he has held since last July.

GRAHAM B. BROWN has been named works manager of the Tube Reducing Corporation, Wallington, N. J. Mr. Brown has been with the concern since 1951.

Ohio

OSBORN MFG. CO., Cleveland, Ohio, announces three promotions in the Machine Division: EARL B. SMITH, formerly sales engineer for Ohio and West Virginia, has been made assistant manager; J. DOYLE ROBBINS, who was assistant to the vice-president, has assumed Mr. Smith's position of sales engineer in the states mentioned; and LEONARD N. MCKIBBEN, formerly supervisor of sales service, has been named sales engineer for the New England territory.

ANDREW N. ESHMAN and L. M. GARY have joined the service engineering group of the Mallory-Sharon Titanium Corporation, Niles, Ohio. Mr. Eshman will be responsible for engineering service relative to fabrication, metallurgy, and processing of titanium sheet, while Mr. Gary will aid customers in the development and improvement of forging and fabricating techniques.

JAMES BERE has been appointed assistant general manager of the Hamilton, Ohio, plant of the Clearing Machine Corporation, Chicago, Ill. Mr. Bere until recently managed the southern Ohio sales territory for Clearing, and prior to that, worked in the Chicago sales office. He joined the company in 1946.

WILLIAM C. WOODWARD, assistant manager of forging sales since last August, has been promoted to the post of manager of forging sales at the Aluminum Co. of America, Pittsburgh, Pa. His headquarters will be at the Cleveland, Ohio, works. Mr. Woodward succeeds the late M. W. Hodgdon.

ARTHUR W. JOHNSON has joined the engineering staff of the E. W. Bliss Co., Rolling Mill Division, Salem, Ohio. He was formerly chief engineer of the Arms Franklin Corporation. Mr. Johnson participated in the development of the Weld-A-Matic Splicer, recently acquired by Bliss.

ROBERT F. LAY, chief engineer of the Product Division of the Cooper-Bessemer Corporation, Mount Vernon, Ohio, has been appointed assistant general sales manager. EUGENE L. MILLER, who was supervisor of application engineering, has been made assistant general manager.

ROBERT A. MANES has been appointed vice-president of the Cleveland Instrument Co., Cleveland, Ohio. He will head up the company's expanding sales activities on precision dimensional gaging equipment. Mr. Manes was formerly associated with the Fonda Gage Co.

DOW CHEMICAL CO., Midland, Mich., has opened a field office at 2330 Victory Parkway, Cincinnati, Ohio, to serve southern Ohio, southeastern Indiana, and sections of Kentucky and West Virginia. FIELDING H. YOST, JR., is manager.

DENZIL HAWKINS has been appointed manager of the Dayton, Ohio, warehouse by the Producto Corporation, Detroit, Mich. Mr. Hawkins recently joined the company as sales representative in the Indiana and southwestern Ohio territories.

STEEL IMPROVEMENT & FORGE CO., Cleveland, Ohio, recently purchased the CHAMPION FORGE DIVISION OF CHAMPION INDUSTRIES, INC., also of Cleveland.

WESTINGHOUSE ELECTRIC CORPORATION, Pittsburgh, Pa., has announced plans to expand its Small Motor Division by constructing a new plant at Upper Sandusky, Ohio.

Pennsylvania and Washington, D. C.

CARPENTER STEEL CO., Reading, Pa., announces the promotion of four men in the Middle West: WILLIAM J. ERVIN, SR., formerly branch manager of the Indianapolis mill branch warehouse, to district manager of the Indianapolis territory and the Southwest, with headquarters in Indianapolis; PAUL HOLTZ, branch manager at Chicago, to assistant district manager and with additional sales and service responsibilities in the St. Louis area; WILLIAM J. STEPHENS from assistant to branch manager at St. Louis, Mo.; and WILLIAM C. KUNKELMAN, formerly branch manager at Cincinnati, to southeastern manager in the Atlanta, Ga., and Cincinnati and Dayton, Ohio, territories, with headquarters in Cincinnati. The reorganization resulted from the retirement of K. L. CRICKMAN, regional manager, who formerly supervised this entire area. Mr. Crickman, whose headquarters were in Indianapolis, was with Carpenter for twenty-six years.

ALUMINUM CO. OF AMERICA, Pittsburgh, Pa., announces that two of its major operating divisions have been consolidated—the Die Castings Division and the Castings Division. The consolidation followed the retirement of G. M. ROLLASON, who was general manager of the Die Castings Division. A. B. NORTON, who was general manager of the Castings Division, will now also direct die-castings operations. H. C. ERSKINE, who was assistant general manager of the Die Castings Division, will now hold this position in the enlarged Castings Division. This Division will now include the die-casting works at Garwood, N. J., and Chicago, Ill., as well as aluminum and magnesium foundries and other operations at Cleveland, Ohio; Detroit, Mich.; Bridgeport, Conn.; Vernon, Calif.; and Buffalo, N. Y. Mr. Rollason was with Alcoa for thirty-five years, beginning his career in 1919 as a research engineer at Cleveland. After holding several executive positions, he was named manager of the Die Castings Division in 1933.

SEMON H. STUPAKOFF, formerly president of the Stupakoff Ceramic & Mfg. Co., Latrobe, Pa., was recently elected vice-president of The Carborundum Company, Niagara Falls, N. Y. The Stupakoff concern, which manufactures ceramic and other components used in the electrical industry, was acquired by Carborundum in early 1954 and is now known as the Stupakoff Ceramic & Mfg. Co., a Division of The Carborundum Company. In the capacity of vice-president, Mr. Stupakoff will continue to direct the activities of the Division. He started in the laboratories of his father's establishment at Pittsburgh in 1916, and spent practically his entire business career in the company, becoming its treasurer in 1925 and president three years later.

STANDARD STEEL WORKS DIVISION OF THE BALDWIN-LIMA-HAMILTON CORPORATION, Burnham, Pa., has appointed the following sales engineers: FRANCIS W. KLOTZ to the Syracuse, N. Y., territory; and PHILIP E. PACINI to the Pittsburgh, Pa., area. ROBERT T. MCCLELLAN has been appointed a sales representative for this Division by the parent company. Serving central Pennsylvania, Mr. McClellan will make his headquarters in Burnham, where he has been senior correspondent in the general sales office since 1947.

JOEL HUNTER has been elected president of the Crucible Steel Co. of America, Pittsburgh, Pa., succeeding WILLIAM H. COLVIN. Mr. Colvin, who was president since 1945, will continue as a member of the executive committee and board of directors, however. Mr. Hunter joined Crucible in 1951 as vice-

WESSON Engineering Skill *Improves*

The World's Most Perfect TOOL HOLDER...

NOW

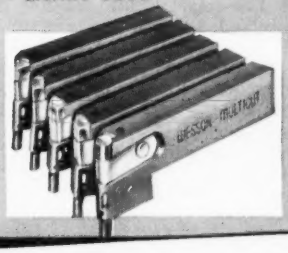
A BUILT IN, FOOLPROOF CARBIDE FLUSH GAGE!

The carbide flush gage is precision ground for foolproof accuracy. Any operator can reset the insert quickly and with positive accuracy.

NEW... The elliptical slot makes removal of the insert simple and easy.

CHECK THESE ADVANTAGES...

- ✓ Rapid, accurate set up reduces downtime.
- ✓ Foolproof adjustment of insert.
- ✓ Gage is permanent part of holder.
- ✓ Eliminates height gages, rules, etc., ordinarily required.
- ✓ Elliptical slot permits fast removal of insert.
- ✓ All this on the superior Multicut Holder at NO EXTRA COST!



Over 101 standard sizes—11 Styles available from stock!

Wesson's Multicut band type holders, long famous as the industry's most efficient tool holder, now offers you these new unique features to save you time and money.

The "built-in" solid Wessonmetal flush gage, a permanent part of the holder, provides positive accuracy and reduces set up time. The addition of the elliptical slot permits the operator to remove the insert in a split second even when the insert is "baked in" by mixtures of coolant and metal powder due to the heat generated by severe cutting operations. These features, plus the replaceable band, assure you the best possible efficiency in the Multicut Holder. Call the Wessonman in your area for complete details.

THE WESSON MAN *in your area has many case histories proving the high performance rates of Wesson Tools and Wessonmetal. Call him today.*

WESSON COMPANY

president in charge of finance, and was elected a director of the company and executive vice-president in 1953.

MARSHALL POST has retired as vice-president in charge of operations for the Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa. Mr. Post, who has seen more than half a century of service in the steel foundry industry, started his career in 1900 with the American Steel Foundry Co., Granite City, Ill. After having been associated with several other companies, he joined Birdsboro in 1925, where he remained for twenty-nine years. He started as works manager and was later named vice-president and a member of the board of directors.

DEAN VALENTINE has been made Philadelphia branch manager, a newly created position, by the Moore Products Co., Philadelphia, Pa. He was formerly assistant sales manager, a position which will be assumed by RALPH H. OWENS, who was manager of the Pittsburgh office. RICHARD C. HOPKINS will fill this vacancy. Mr. Hopkins, who has been with the Moore organization since 1948, was senior application engineer.

FRED H. SCHONBERGER, Philadelphia sales representative for the Carboloy Department of General Electric Co., Detroit, Mich., since 1937, recently retired. While with Carboloy, Mr. Schonberger was active in the development and promotion of field training programs in cemented carbide tool use and maintenance.

ATLAS CHAIN & MFG. CO. has moved to its new office and factory at 288 N. Main St., Doylestown, Pa. The company plans to make additions to the present 55,000-square foot plant to house production and laboratory facilities now located at Ontario St. in Philadelphia.

JOHN P. MOORHOUSE, purchasing agent at the Standard Pressed Steel Co., Jenkintown, Pa., has been assigned the duties of director of purchases, thus taking on other responsibilities, including the buying of machinery, in addition to his regular duties.

DONALD C. BURNHAM has joined the Westinghouse Electric Corporation, Pittsburgh, Pa., as vice-president in charge of manufacturing. He succeeds T. I. PHILLIPS, who is retiring after thirty-nine years of service. Mr. Burnham comes to Westinghouse from the General Motors Corporation, where he recently held the positions of manufacturing manager and assistant chief engineer of the Oldsmobile Division. Mr. Phillips joined Westinghouse in 1915 as a toolmaker. After various promotions, he became a vice-president in 1941, and two years later was placed in charge of the East Pittsburgh divisions. In 1952, he was named to the president's staff in charge of manufacturing.

Donald C. Burnham, vice-president in charge of manufacturing, Westinghouse Electric Corporation

EDWIN T. JACKMAN and GEORGE R. BROTHERTON have joined the sales staff of the Vanadium-Alloys Steel Co., Latrobe, Pa. Mr. Jackman will be a sales representative in the Detroit area, and Mr. Brotherton in the Midwestern States.

WALTER W. HAMBRECHT has been made manager of the Finishing Division of the Standard Pressed Steel Co., Jenkintown, Pa., fastener and shop equipment manufacturer. Mr. Hambrecht was formerly assistant to the supervisor of form and finish.

JOSEPH F. CHALUPA has been named assistant works manager of the Aviation Gas Turbine Division of the Westinghouse Electric Corporation. He will be in charge of plant operations at the Division's South Philadelphia, Pa., plant.

SALES & SERVICE MACHINERY CO., INC., Philadelphia, Pa., announces that it has changed its name to DELAWARE VALLEY MACHINERY, INC.

CAPTAIN R. E. W. HARRISON, mechanical engineer and head of the Production Engineering Branch of the Bureau of Ships, United States Navy, retired from active duty recently. Captain Harrison was also for many years in the industrial field, having served successively as assistant works manager of the Churchill Machine Tool Co. in England; chief engineer in the Grinder Division of the Cincinnati Milling Machine & Grinder's Co., vice-president of the Chambersburg Engineering Co.; vice-president of Clarke-Harrison, Inc.; and president of the U. S. Management Engineering Co.

Brazil

BRASSINTER S. A. is a newly formed concern in Sao Paulo, Brazil, which will become the counterpart of Firth Sterling, Pittsburgh, Pa., in Brazil. DR. VICENTE CHIAVERINI and DR. LUIZ C. CORREA DA SILVA, general manager and production manager, respectively, are now in Pittsburgh for the purpose of studying Firth Sterling processes and manufacturing methods involved in the production of sintered tungsten carbides and tool steels. DR. ARY TORRES is president of the South American company, and DR. FRANCISCO MATARAZZO NETO, vice-president.

Coming Events

JULY 13-15—WESTERN PLANT MAINTENANCE SHOW to be held at the Pan Pacific Auditorium, Los Angeles, Calif. For further information, write to Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

SEPTEMBER 21-23—Annual meeting and exhibition of the SOCIETY FOR EXPERIMENTAL STRESS ANALYSIS in conjunction with the First International Instrument Congress and Exposition, to be held at the Bellevue-Stratford Hotel, Philadelphia, Pa. Write to the general chairman, Frank G. Tatnall, Box 4034, Chestnut Hill, Philadelphia 18, Pa.

OCTOBER 1-2—Annual meeting of the STANDARDS ENGINEERS SOCIETY at Haddon Hall, Atlantic City, N. J. Secretary, F. M. Oberlander, Box 281, Camden, N. J.

OCTOBER 24-27—Semi-annual meeting of the AMERICAN GEAR MANUFACTURERS ASSOCIATION, at the Edgewater Beach Hotel, Chicago, Ill. Executive secretary, John C. Sears, One Thomas Circle, Washington 5, D. C.

NOVEMBER 1-5—Thirty-sixth National Metal Exposition sponsored by the AMERICAN SOCIETY FOR METALS at the International Amphitheatre, Chicago, Ill. Secretary, W. H. Eisenman, 7301 Euclid Ave., Cleveland 3, Ohio.

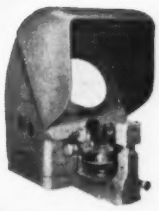
NOVEMBER 29-DECEMBER 2—First INTERNATIONAL AUTOMATION EXPOSITION to be held at the 244th Regiment Armory, New York City. For further information, write to Exposition, 845 Ridge Ave., Pittsburgh 12, Pa.

DECEMBER 2-7—Twenty-first National Exposition of Power and Mechanical Engineering under the auspices of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS, at the Commercial Museum, Philadelphia, Pa. Manager, Charles F. Roth, 480 Lexington Ave., New York 17, N. Y.

11 MODELS

3 SCREEN SIZES

Pedestal Type
14" Diam. Screen



Bench Type
14" Diam. Screen
4 Models

Bench Type
5¾" x 7¾" Screen
3 Models

Unsurpassed Inspection Versatility

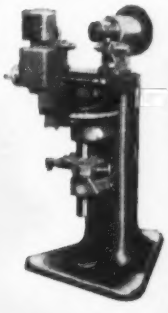
JONES & LAMSON OPTICAL COMPARATORS

The Essence of Quality Control

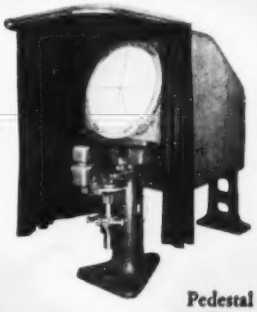
Jones & Lamson Optical Comparators are designed and built like rugged machine tools to withstand vibration and hard use. Yet they have the built-in accuracy to satisfy the most exacting laboratory standards.

- **They meet** the requirements of toolroom, laboratory and production inspection.
- **They precisely measure** height, depth, lead or spacing, as well as angles to degrees and minutes. They will measure to .0001".
- **They compare** intricately contoured parts with a master outline—and measure the amount of error.
- **They are convenient** to operate, easy to set up and read direct—*without computation.*
- **They operate** under normal lighting conditions. *No darkroom is needed.*
- **They will photograph** the enlarged shadow and record its relationship to a master chart.
- **Several persons** may study the shadow *at the same time.*
- **They will inspect** and measure surface contours, as well as profiles of objects such as type faces, stamping dies, punches, worn tools, etc.

Vertical Type
14" Diam. Screen



Direct
Projection
Type



Pedestal Type
30" Diam. Screen

P.S. A complete line of STANDARD CHARTS and FIXTURES is maintained by us.

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J&L COMPARATOR DIV.
Dept. 710

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Springfield, Vermont, U. S. A.
Please send Comparator Catalog No. 402.

NAME_____ TITLE_____

COMPANY_____

STREET_____

CITY_____ STATE_____

Obituaries

Clarence W. Hamilton

Clarence Worthington Hamilton, public relations director and administrative staff member at the Sheffield Corporation, Dayton, Ohio, died on June 7 after a second heart attack while on a business trip to Canada, at the age of sixty-two years. Mr. Hamilton joined Sheffield eleven years ago. Prior to this, he was public relations director for the Globe-Wernicke Co. in Cincinnati. In 1952, Mr. Hamilton was given a life membership in the American Ordnance Association. He was also a member of the Dayton Press Club.

Clarence W. Hamilton

Lloyd E. Honeywell

Lloyd E. Honeywell, retired advertising manager of the National Acme Co., Cleveland, Ohio, died suddenly at his home on June 7 at the age of sixty-seven years. His service with the company began in 1912 as assistant advertising manager, and for fifteen years—until his retirement a year ago—he was advertising manager. Mr. Honeywell was born in Chardon, Ohio, and was educated in Cleveland schools and at Wooster (Ohio) College. He participated in advertising committee work for the National Machine Tool Builders' and National Screw Machine Products Associations. Mr. Honeywell was still active with the company's advertising agency at the time of his death.

Lloyd E. Honeywell

ERNEST A. HERRCKE, manager of the Chicago office of the National Automatic Tool Co., Inc., Richmond, Ind., died on April 10, at the age of sixty-five years. Mr. Herrcke became associated with the company in 1924 as an assistant engineer. He transferred to the sales department in 1927 and became assistant sales manager later that year. In 1937, he was made manager of the Chicago office, the position he held until his death. Mr. Herrcke is survived by his wife.

* * *

Life of Forging Dies Boosted by Employing Vapor-Blasting

International Harvester's East Moline Works has boosted forging die life by more than 25 per cent with the vapor-blast metal finishing process. Following controlled tests which increased die life from 35,000 pieces between sinkings up to 90,000, this method was adopted as a routine operation in finishing, repairing, and redressing forging dies.

Previously, dies were prepared by hand sinking and scraping, and 35,000 parts were produced before redressing was necessary. The first deviation from the old practice was the addition of chromium-plating, which boosted the life to 69,000 pieces. When vapor-blasting was added to this procedure, the figure jumped to 120,000.

In the next test, the chromium-plating was excluded so that the operation included hand sinking and scraping, followed by vapor-blasting. This resulted in an average life of 90,000 pieces for each die and was adopted as standard procedure.

New Books and Publications

METALS AND HOW TO WELD THEM. By T. B. Jefferson and Gorham Woods. 322 pages, 5 3/4 by 8 3/4 inches. Published by the James F. Lincoln Arc Welding Foundation, Cleveland 17, Ohio. Price, $2.

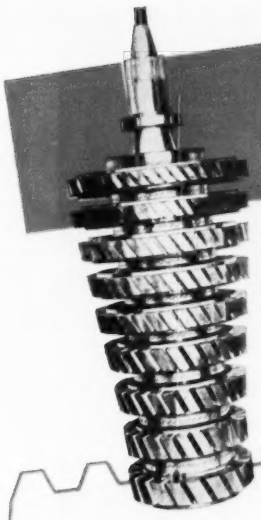
This is a combination text and reference book to give all users of welding a practical working knowledge and source of information for designing and making better welds at lower cost. The first six chapters are devoted to an elementary discussion of metals, their mechanical and physical properties and uses. The fundamentals of metallurgy and their significance in heat-treating and welding are explained. This information is then related to correct welding procedures for steels, cast iron, non-ferrous materials, and hard-facing. The final section of the book treats the subjects of making good welds, trouble-shooting, cost estimating, and welding terms. Over 170 drawings, photographs, and tables illustrate the material.

PROFITABLE SMALL PLANT MANAGEMENT. By Malcolm H. Gotterer. 318 pages, 5 1/2 by 8 1/4 inches. Published by Conover-Mast Publications, Inc., 205 E. 42nd St., New York 17, N. Y. Price, $5.50.

This book is intended for three groups of businessmen—those who wish the information necessary to formulate a sound and profitable cost reduction or management development program; those who are faced with the problem of supervising and evaluating the results of management specialist employed on a full-time, part-time, or consultant basis; and those who wish to broaden their knowledge of management theories and applications. Chapter headings are as follows: The Small Plant in Our Economy; A Management Program for small business; Organization; Plant Lay-out; Methods Improvement; Production Standards; Wage Incentives; Production Control; Materials Control; Manpower Management; Job Evaluation; Merit Rating; and Cost Control.

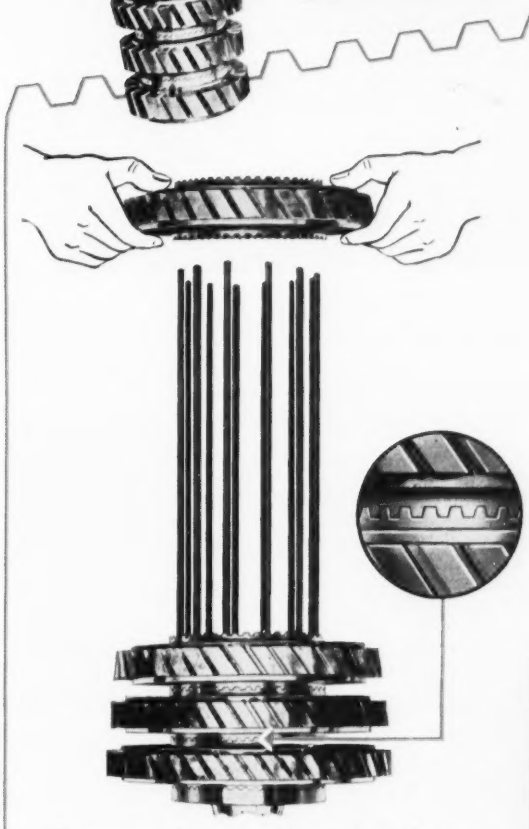
LUBRICATION OF INDUSTRIAL AND MARINE MACHINERY (Second Edition). By the late William Gordon Forbes, revised by C. L. Pope and W. T. Everitt. 351 pages, 6 by 9¼ inches. Published

GLEASON CURVIC COUPLINGS

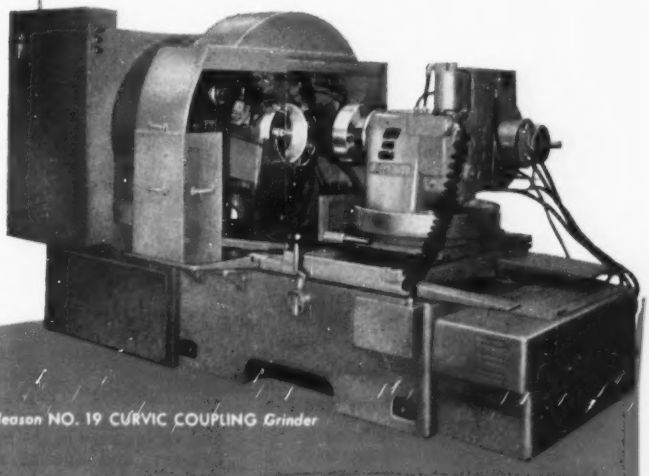


for JET ENGINES

No. 19 Curvic Coupling Grinder is entirely automatic for grinding, from the solid, Curvic teeth in face couplings. Curvic Couplings are widely used for joining Compressor Rotor Discs for jet engines. Other applications include locomotive gas turbine rotors, built-up crankshafts and shafting requiring precision connections.



The accuracy and uniformity of Gleason Curvic Couplings are such that complete interchangeability is possible, allowing for easier manufacture and assembly of the coupled parts.



Gleason NO. 19 CURVIC COUPLING *Grinder*

GLEASON

GLEASON WORKS

BUILDERS OF BEVEL GEAR MACHINERY FOR OVER 85 YEARS

1000 UNIVERSITY AVE. · ROCHESTER 3, NEW YORK

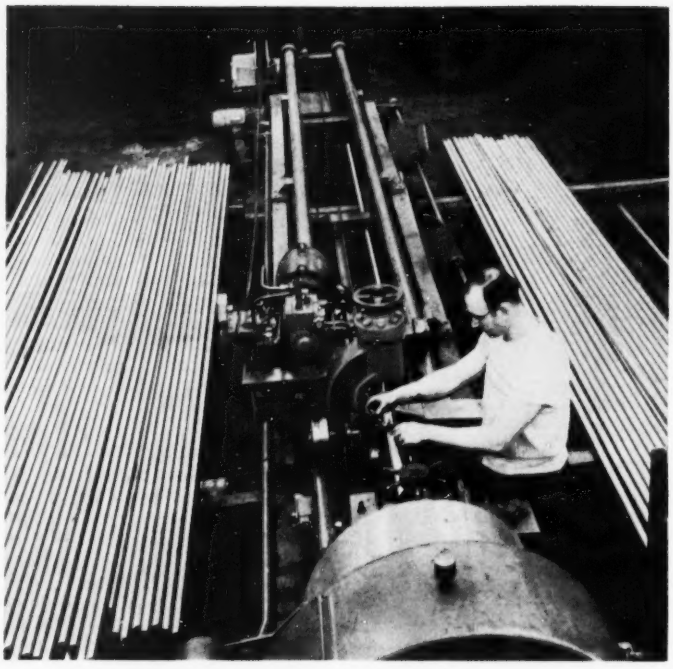
by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price, $6.50.

This book, revised by the Messrs. Pope and Everitt, who are lubrication engineers with the Eastman Kodak Co., has been modernized to include the developments of the last ten years, although retaining its major purpose of explaining the fundamental characteristics of conventional lubricants. The selection, application, and control of lubricants and lubricating devices are discussed simply and non-mathematically. Practical examples are given on how this basic information can be applied. Following are the chapter headings: Chemistry of Petroleum; Distillation; Distillation of Lubricating Oils; Refining Light Distillates and Lubricating Oils; Dewaxing and Effect of Wax in Lubricating Oils; Fatty Oils; Blending; Solid Lubricants; Additives for Lubricants; Physical Tests; Functional Tests; Greases; Synthetic Lubricants; Specifications; Bearing Lubrication and the Formation of Oil Films; Ball and Roller Bearings; Methods for Applying Lubricants; Oil Purification and Reclaiming; Machine Storage and Shipment; Steam Engines; Steam Turbines; Hydraulic Turbines; Hydraulic Systems and Fluid Couplings; Air Compressors and Vacuum Pumps; Pneumatic Tools; Refrigerating Machines; Reduction Gears; Internal-Combustion Engines; Gasoline Engines; Internal-Combustion Engine Lubricating Oil; Heat-Treating Oils; Cutting Oils; Lubrication of Equipment; and Lubrication Engineering.

TITANIUM AND TITANIUM ALLOYS. By John L. Everhart. 184 pages, 4 1/4 by 6 3/4 inches. Published by the Reinhold Publishing Corporation, 330 W. 42nd St., New York 36, N. Y. Price, $3.

The engineer or designer interested in the possibilities of applying titanium in the solution of his problems will be interested in this survey. It is not intended for the producer of titanium, nor for those engaged in research and development, since it deals almost exclusively with manufacturing processes involved in its use. Following are the chapter headings: High-Purity Titanium; Properties of Commercial Titanium; Properties of Commercial Titanium Alloys; Heat-Treatment; Forming and Fabricating; Joining; Machining and Grinding; Cleaning and Finishing; and Applications.

AMERICAN STANDARD BUTTRESS SCREW THREADS (ASA B1.9-1953). 17 pages, 8 1/2 by 11 inches. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y. Price, $1.



Bar-finishing machine used in the initial machining of bar stock for the manufacture of track pins

Caterpillar Expands Parts Service and Manufacturing Facilities

Improved parts service to its eastern and export customers and increased facilities for manufacturing track replacement parts are provided by the Caterpillar Tractor Co. in its new plant at York, Pa. Steels employed in this dual-purpose plant are largely those that go into track link and track roller-rim forgings. These parts, as received from the vendor, still have the coarse-grain structure produced in the forging operation. They then receive grain refining treatment in a cycle annealing furnace.

The furnace, approximately 100 feet long, can handle a 3000-pound load of steel every fifty minutes. Parts such as links are quenched in circulated water to the full hardness obtainable. After a subsequent tempering operation, they have a fine-grain, tough structure that is difficult to machine but durable in service. Wear surfaces are then induction hardened. After quenching, they pass through a tempering furnace to restore the desired degree of toughness.

Automatic conveyors, both above and below ground, transport the parts from one operation to the next. Only five men are required for machine loading purposes from the time the rough links are brought into the shop until ready for assembly.

Maker of Pumps and Valves for Hydraulic Positioning and Clamping—Correction

In the leading article in June MACHINERY, "Hydraulic Positioning and Clamping" (pages 155 to 162), the statement was made that pumps and valves used in the hydraulic jigs, fixtures, and special machines described were made by Vickers, Inc., Detroit, Mich. This is not correct, as these items are British-made Vickers-Detroit products, manufactured by Stein & Atkinson, Ltd., London, England, under license of Vickers-Detroit.

Motion Picture Features Machine Tool and Small Tool Manufacture

The Brown & Sharpe Mfg. Co. has announced the release of a motion picture entitled "Meet Brown & Sharpe," which illustrates interesting highlights in the operations involved in the production of a multiple line of precision machine tools and small tools. The 16-millimeter film, in color and with sound, is available through thirteen Brown & Sharpe offices located in principal cities in the United States or from the main office in Providence, R. I.

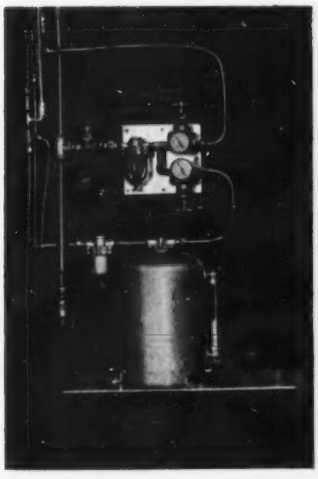
Norgren Spray-Lube System

DOUBLES OUTPUT OF VERTICAL TURRET LATHE at O. K. RUBBER, INC.

4 Spray-Lube lines give full spray coverage over 14¼" cutting edge of tool.

On roughing and finishing a straight ribbon tread on cast aluminum tire capping mold, Norgren Spray-Lube:

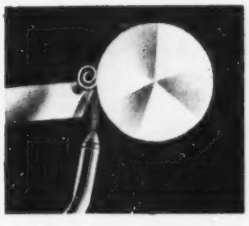
- stepped up surface cutting speed from 45 to 75 rpm.
- increased depth of cut.
- eliminated welding of chips on cutting tool.
- ended galling of work pieces.
- reduced tool maintenance.
- improved quality of work.



Spray-Lube control panel and liquid reservoir are centrally located for several machines.

WRITE FOR COMPLETE DATA NORGREN BLUEPRINT SL-2

C. A. Norgren CO.
3419 So. Elati, Englewood, Colo.



Coolant where you need it ... spray is applied to work area from any required direction to thoroughly lubricate critical contact areas between cutting tool and work piece.

Step Up Production Speed. Rapid cooling at the cutting point will enable you to increase both the speed and the feed of the cutting tool, and still improve workmanship and tool life. Notable increases in machine output have resulted.

PIONEER AND LEADER IN OIL-FOG LUBRICATION FOR 26 YEARS

VALVES FILTERS HOSE ASSEMBLIES REGULATORS LUBRICATORS

NEW! A one-man Stretch-Wrap Former with instant work-length adjustment!

Designed to produce parts in an unusually wide range of work lengths, this new Hufford model 102 offers many work-saving features

ONE-MAN OPERATION—All loading and forming functions are easily controlled by a single operator.

INSTANT WORK-LENGTH ADJUSTMENT—Design has been reduced to its simplest form. Note work-length capacity is varied merely by extending or retracting cylinder rods to desired spacing between jaws.

WIDE RANGE OF LENGTHS—Parts as short as 12" or as long as 72" may be accommodated.

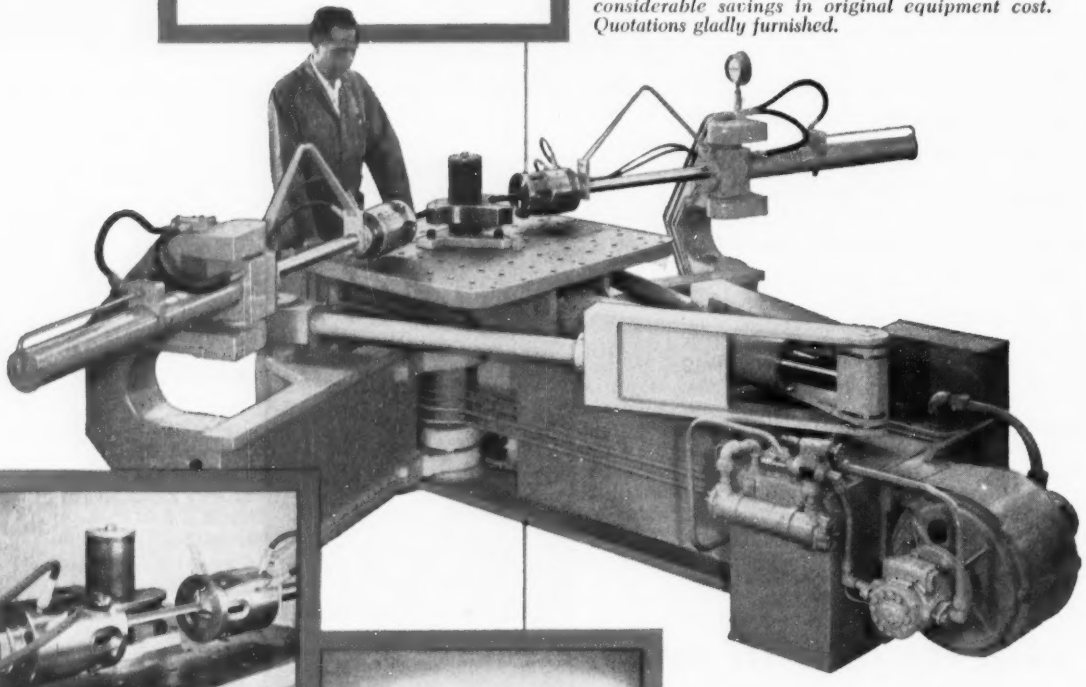
DOUBLING THE WORK-LENGTH CAPACITY is offered as a possibility by operating two machines side by side, disconnecting inside arms of each. Tension cylinder capacity remains the same.

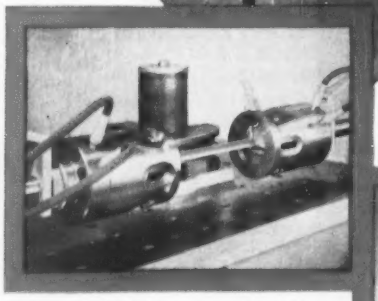
SIMULTANEOUS ARM MOVEMENT—Arms may be automatically stopped at any portion of their travel by electric controls.

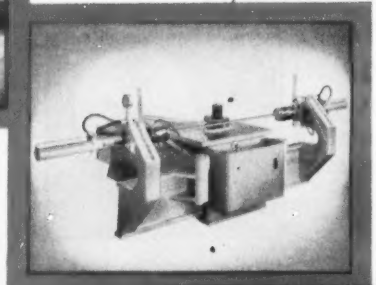
MANUAL TENSION CONTROL—Tension pressure is applied by manually operated levers.

The new model 102 is Hufford's latest development towards modernization of existing equipment. It effectively relieves larger machines of the smaller jobs at considerable savings in original equipment cost. Quotations gladly furnished.

HUFFORD
MODEL 102
CAPACITY 5 TONS







The model 102 easily and quickly forms parts over an unusual range of lengths. Since both arms pivot on the same pin small radii and short parts are easily and economically produced.

With jaws fully retracted, finished parts up to 72" long may be formed.

BRIEF SPECIFICATIONS – MODEL 102

Tension Capacity	10,308 lbs.
Max. Die Height	10"
Min. Die Length for 180° Bend at Any Tonnage	7"
Max. Die Length for 180° Bend at Full Tonnage	45"
Tension cylinder stroke, each	30"
Maximum part length (tension cylinders fully retracted)	72"
Minimum part length	12"

HUFFORD
Machine Works Inc.
EL SEGUNDO, CALIFORNIA

Manufacturers of

PRECISION HYDRAULIC STRAIGHTENING PRESSES
HYDRAULIC METAL FORMING BULLDOZERS • HYDRAULIC STRETCH-LEVELING UNITS
HYDRAULIC STRETCH WRAP FORMING MACHINES
PORTABLE HYDRAULIC ELEVATORS • HYDRAULIC COMPACTION PRESSES
CUSTOM-MADE HYDRAULIC MAJORING TOOLS AND ACCESSORIES

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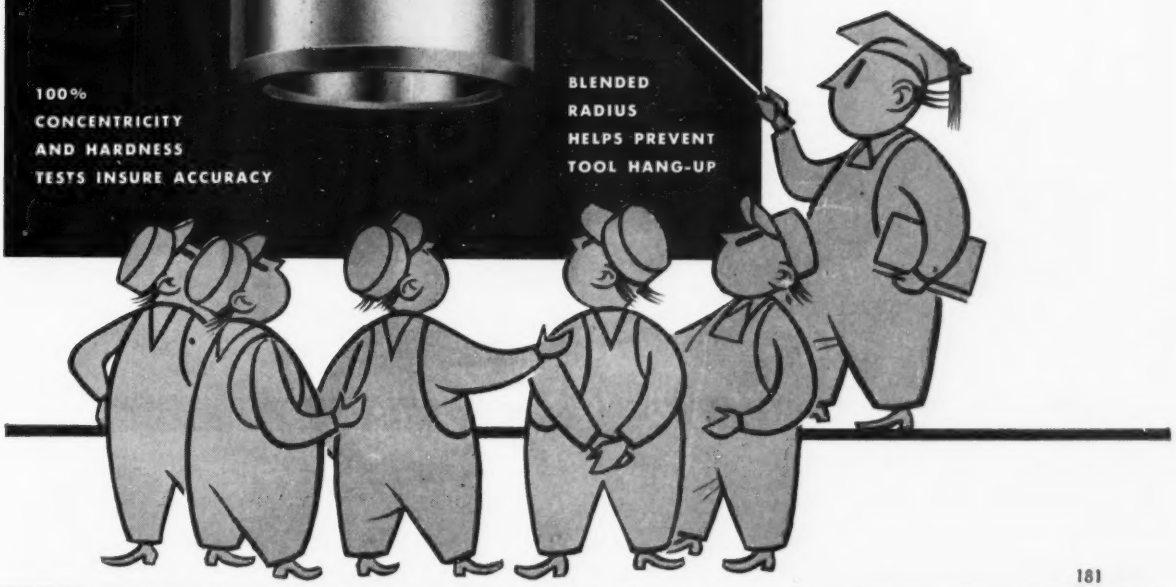
UNIVERSAL DRILL BUSHINGS

INSURE PERFECT ALIGNMENT AND LONG LIFE OF PRODUCTION TOOLS

KNURLED HEADS PROVIDE GOOD GRIP
SUPERFINISH BORES REDUCE TOOL WEAR
100% CONCENTRICITY AND HARDNESS TESTS INSURE ACCURACY
BLENDED RADIUS HELPS PREVENT TOOL HANG-UP

Universal Drill Bushings are available in a complete range of standard sizes and lengths. Special sizes made to order. Write to Universal Engineering Sales Co., 1060 Broad St., Newark 2, N. J.; 5035 Sixth Ave., Kenosha, Wis.; or the home office.



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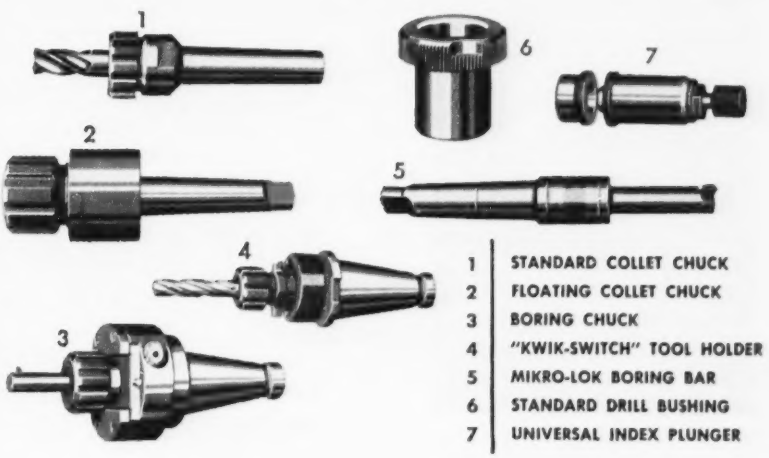
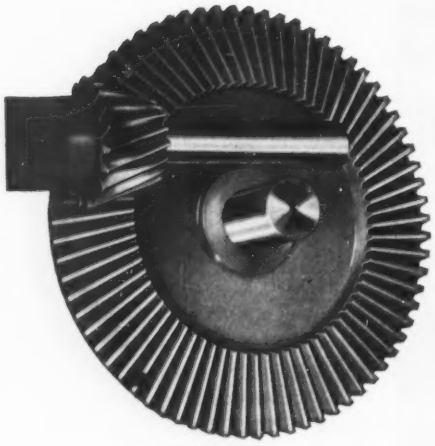
UNIVERSAL ENGINEERING COMPANY
FRANKENMUTH 2
MICHIGAN



1	STANDARD COLLET CHUCK
2	FLOATING COLLET CHUCK
3	BORING CHUCK
4	"KWIK-SWITCH" TOOL HOLDER
5	MIKRO-LOK BORING BAR
6	STANDARD DRILL BUSHING
7	UNIVERSAL INDEX PLUNGER

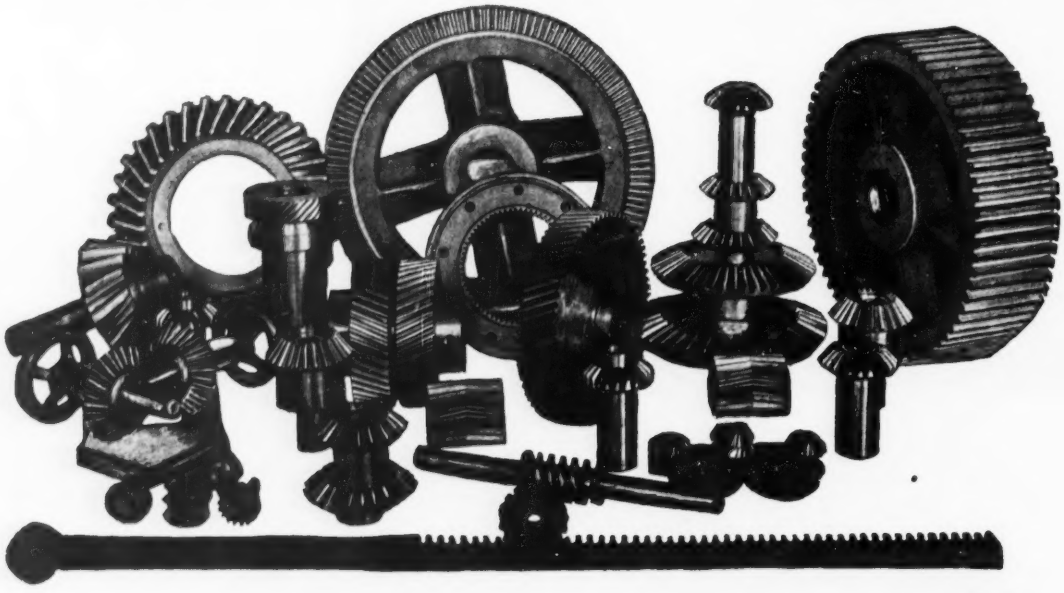


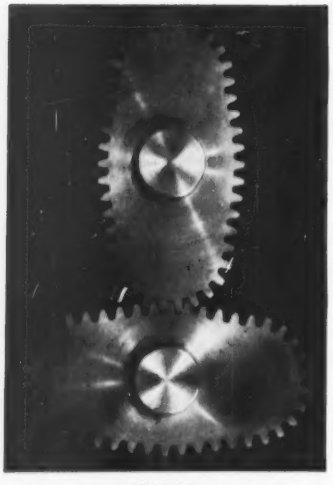
HYPOID

BILGRAM

QUALITY GEARS

SPIRAL BEVEL





OVAL

Bevel Gears with straight or spiral cut teeth — Ellipticals — Herringbones — Helicals — Racks — Spurs — Hypoids — Worms — if you want quality gears economically produced, BILGRAM IS THE ANSWER! Any material, any quantity. Special attention to so-called "difficult" gears. Over 60 years' experience, specially designed equipment and fully modern plant assure satisfaction. Submit your gear problems for economical solution and dependable precision. Estimates gladly furnished.

BILGRAM
GEAR & MACHINE WORKS

Manufacturers of Bevel Gear Generators and Chamfering Machines

1217-1235 SPRING GARDEN ST.

PHILADELPHIA 23, PA.

ELLIPTIC

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NOW
The Leader in Stainless
Socket Cap Screws
OFFERS YOU
THE LEADER POINT
Allen's unthreaded Leader Point permits easier starting, reduces the possibility of cross threading, protects threads from damage if the screw is accidentally knocked or dropped. Your Allen Distributor stocks the largest range of sizes in 18-8 stainless cap screws available anywhere . . . 97 standard sizes #4 x ¼" to ⅝" x 3" with NC threads; #10 x ⅜" to ⅜" x 1½" with NF. Be sure to specify genuine Allen Leader Points.
ALLEN
MANUFACTURING COMPANY
Hartford 2, Connecticut, U.S.A.
STAINLESS SET SCREWS
With the improved Allenpoint, available from your distributor in 54 standard sizes #4 x ⅛" to ½" x 1" NC and #10 in lengths from 3/16" to ¾" NF.
Sold only through leading Industrial Distributors.

for machining, grinding and presswork

A UNIVERSAL COOLANT-LUBRICANT

TOOL LIFE BOOSTED 60 to 80% WITH SHEAR-SPEED SOLUBLE OIL!

machine down-time cut in the production of gears for a large auto manufacturer.

IMPARTIAL TESTS of two highly-rated cutting fluids vs. SHEAR-SPEED Soluble Oil were run under *exactly similar production conditions:* ***same machine, same parts, same cutting speed, same coolant flow, same tool grinding***

	Cutting Fluid X	Cutting Fluid Y	SHEAR-SPEED Soluble Oil	S/S Soluble Oil Gave This:
Average No. gears cut per grind	177.6	193	228	More pieces per grind
Tool stock removed per grind	.0227"	.0288"	.0188"	Less tool wear
No. of grinds per .375" hob wear	16	13	20	Longer tool life
Average tool life	2842 parts	2509 parts	4560 parts	Lower tool cost per piece

Convince yourself of the **amazing** advantages and versatility of SHEAR-SPEED Soluble Oil in your own plant. Sold only on a **satisfaction guaranteed** test basis. Write for **Bulletin SO-53** and price list.

SHEAR SPEED
CHEMICAL PRODUCTS

7175 E. McNICHOLS RD. *A Division of Michigan Tool Co.* DETROIT 12, MICH.

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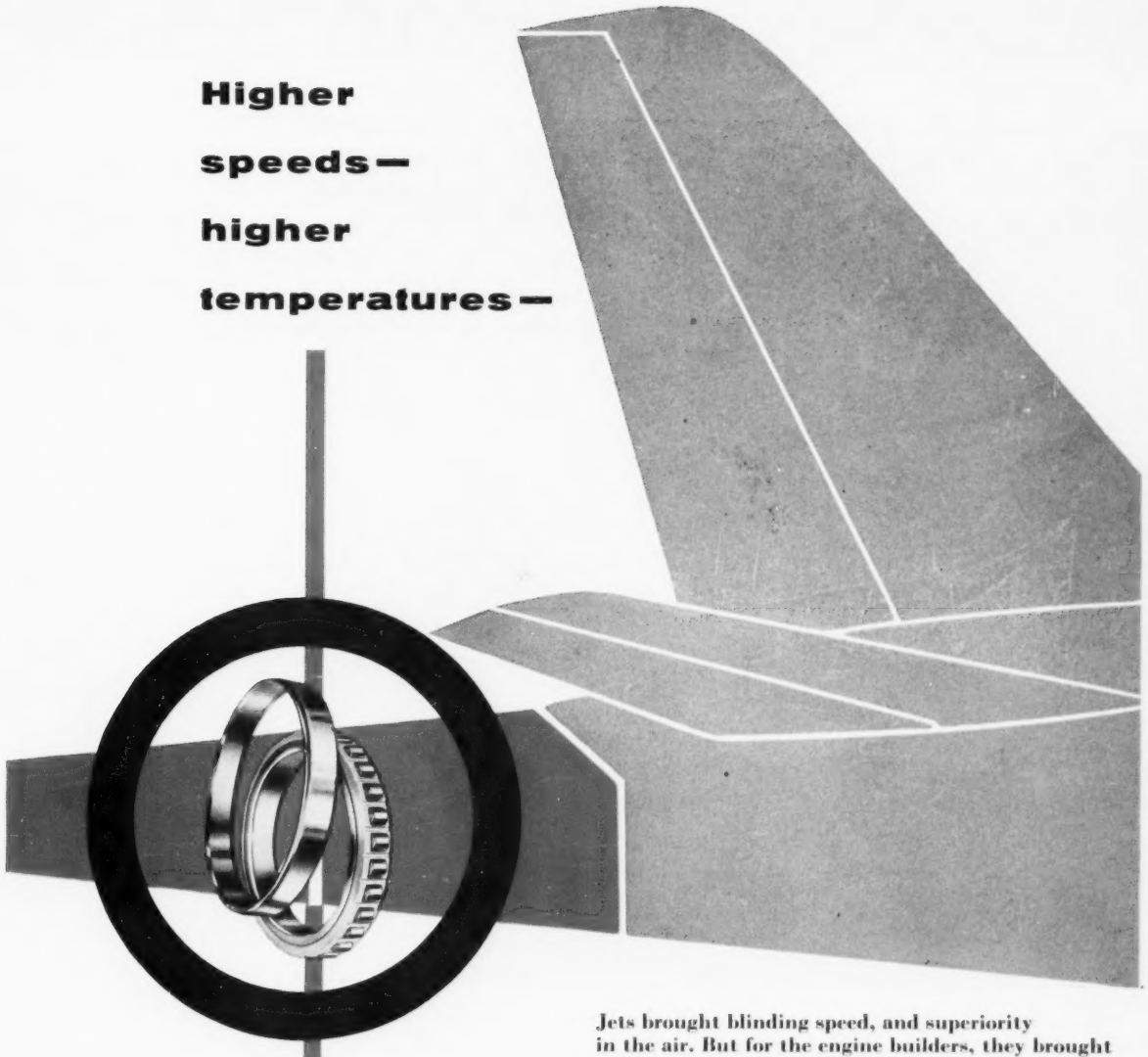
Higher speeds— higher temperatures—



HYATT BEARINGS!

Jets brought blinding speed, and superiority in the air. But for the engine builders, they brought problems. With higher speeds came higher operating temperatures, and engine parts, especially bearings, had to be designed to withstand destructive heat. So designers turned to Hyatt. With unexcelled research and development facilities, modern production equipment, and years of experience, Hyatt was a logical choice. Hyatt know-how assured highest quality in mass production, and since 1944 Hyatt has been a major supplier of jet bearings. When design requirements are beyond the capabilities of ordinary bearings, always call on Hyatt.

Partial list of aircraft equipped with turbo-prop and turbo-jet engines using Hyatt Bearings:

Bell X-5 Research Monoplane
Boeing XB-47C Air Force Medium Bomber
Consolidated—Vultee Model 7002 (XF-92A)
Consolidated—Vultee Turboliner
Douglas XA2D-1 "Skyshark" Navy Attack Bomber
Grumman F9F "Panther" Navy Fighter Plane
Lockheed F-80C "Shooting Star" Fighter Plane
Lockheed F-94A & B Air Force Fighter Plane
Lockheed TO-1 U.S. Navy Version of the F-80G For Use as Jet Trainer
Martin P4M-1 Long Range Navy Patrol Bomber
Martin B-57A U.S. Air Force Version of the English Electric Canberra Medium Bomber
North American AJ-1 "Savage" Navy Carrier Attack and Search Airplane
Northrop F-89A All Weather Fighter Plane
Northrop YRB-49A "Flying Wing" Heavy Bomber
Republic F84F "Thunderjet" Fighter Plane

HYATT

STRAIGHT BARREL TAPER

HYATT BEARINGS DIVISION • GENERAL MOTORS CORPORATION • HARRISON, N. J.

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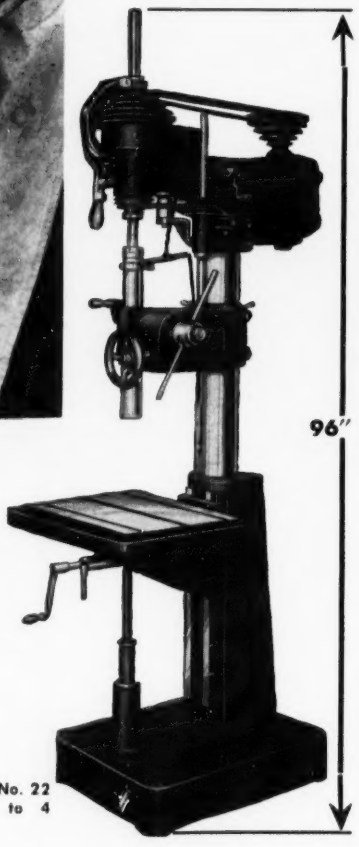
PRODUCTIVE SKILL COMES Naturally

with this convenient large-capacity

"BUFFALO" NO. 22 DRILL



"Buffalo" Pedestal Type No. 22 Drill. Available in 1 to 4 spindles.

You might expect a drill with 1 1/4" capacity in mild steel to be pretty awkward to operate. This big, powerful No. 22 "Buffalo" Drilling Machine has controls designed and placed for easy operation. The No. 22, suitable for large or small work, gives you a drilling range not exceeded by any drilling machine.

It's built for lasting accuracy, too. The 5.5" column, heavy base and head provide great rigidity. The spindle is 1.312" at least diameter, accurately machined, ground and polished from high grade steel. Write for Bulletin 2989-G on these drills that *encourage* productive skill!

BUFFALO FORGE COMPANY

"Buffalo"

440 Broadway — Buffalo, N. Y.

Canadian Blower & Forge Co., Ltd.
Kitchener, Ont.

Drilling **Punching** **Shearing** **Bending**

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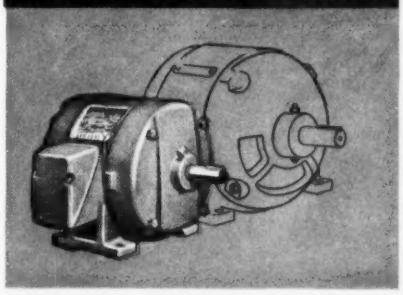
8 reasons why you should

MODERNIZE EQUIPMENT WITH TRI 55 CLAD MOTORS

REG U.S. PAT. OFF.

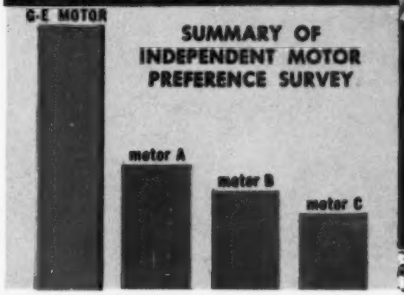
Plan now to modernize your equipment with the all-new General Electric Tri/Clad '55' motor, available now in many ratings; entire line of 1 to 30 hp a-c motors available soon. Contact your G-E Representative. General Electric Company, Section 643-6, Schenectady 5, N. Y.

MORE POWER PER POUND



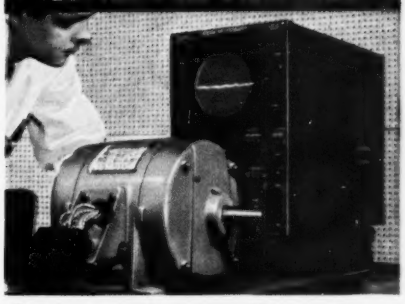
Lighter and smaller Tri/Clad '55' motors in new NEMA frame sizes and ratings save you space and weight, reduce handling costs.

BUYER PREFERENCE



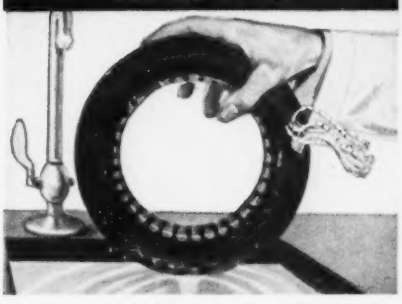
You take advantage of a 2 to 1 buyer preference for the electric motors on your equipment when you buy or specify a G-E motor.

BETTER PERFORMANCE



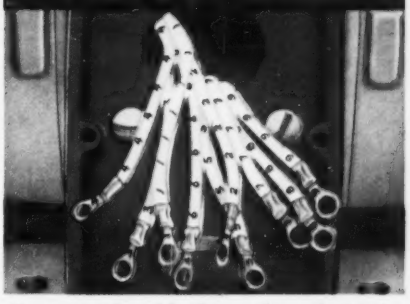
Quieter operation, proved by sound-room tests, is typical of the many performance improvements in the new G-E Tri/Clad '55'.

LONGER LIFE



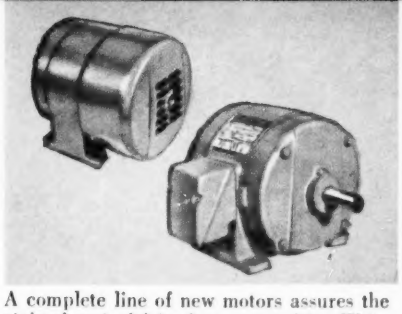
A silicone Dri-film* coating makes insulation shed water—lengthens motor life. Polyester-film insulation is 8 times stronger.

EASIER INSTALLATION

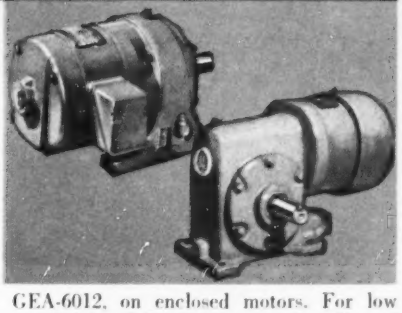


Perma-numbered leads are always instantly read even when wires are taped or clipped. Conduit box has plenty of knuckle room.

COMPLETE LINE OF NEW MOTORS



A complete line of new motors assures the right electrical drive for your machine. Write for Bulletin GEA-6013 on dripproof motors,



GEA-6012, on enclosed motors. For low speed jobs, G.E. offers a complete line of gear-motors. Write for Bulletin GEA-6027.

NEAR-BY SERVICE

CLASSIFIED
Electric Repair Service
—(Continued)
GENERAL ELECTRIC
SMALL MOTOR SERVICE STATION
Complete facilities for in and out-of-warranty repair or exchange of A-C and D-C motors and generators to 15 HP. Authorized distributor G-E motor renewal parts and G-E single-phase motors.
"WHERE TO CALL"
AUTHORIZED G-E MOTOR SERVICE
Street Address..... Phone No.

G-E service is as close as your telephone. Authorized motor service stations provide repair-facilities in all major trading areas.

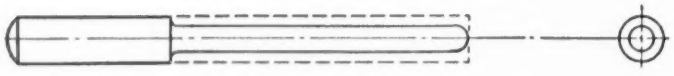
*Reg. trade-mark of General Electric Co.

Progress is our most important product

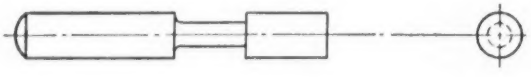
GENERAL ELECTRIC

Swaging Success Stories

Close Tolerances... without Machining



This finished piece used to be made on an automatic screw machine with the long, narrow diameter section turned to .100 ±.003 and a necessary sharp shoulder.



Torrington's swaging experts suggested starting with this simple screw machine blank (to retain the required shoulder).

Result after one rotary swage—an improved finished piece, to a tolerance of ±.001.

Why not write for our informative booklet on swaging that includes complete descriptions of Torrington Rotary Swagers. It may show you how you can achieve a "swaging success story" in your own plant.

See what savings you can make by swaging

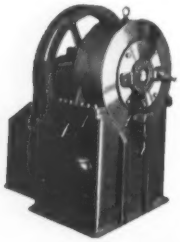
1. Saving in material—swaging uses nearly all the metal.

2. Saving in time—swaging is fast.

3. Saving in labor—unskilled labor can run a swager.

4. Saving in machining—swaging produces finishes accurate to ±.001.

5. Saving in finishing operations—swaging produces high finish, better hardness and resiliency.

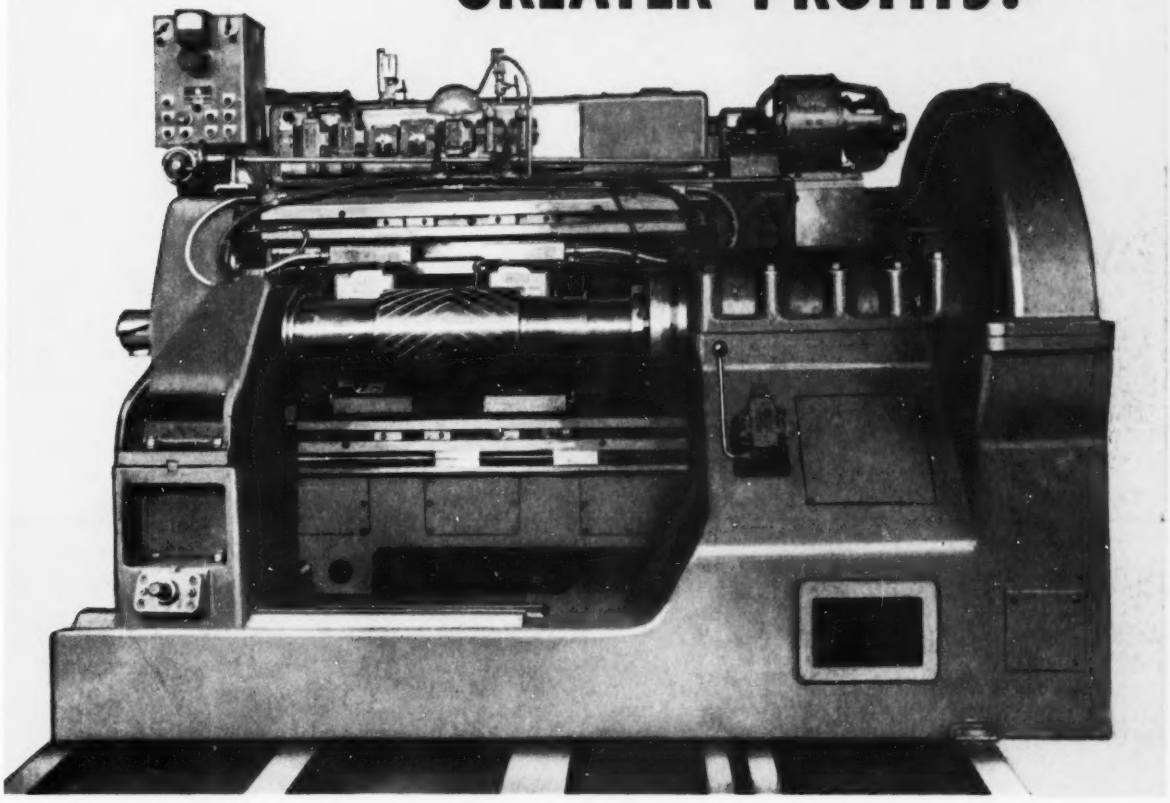


THE TORRINGTON COMPANY
Swager Department
300 North Street, Torrington, Conn.
Makers of Torrington Needle Bearings

TORRINGTON ROTARY SWAGING MACHINES

For more information on products advertised, use Inquiry Card, page 265

HOW TO "PRECISION GENERATE" GREATER PROFITS!



The speed, in operation and set-up, of a Farrel-Sykes "Twin-Head" gear generator, will cut your man and machine hours, and therefore decrease your manufacturing costs. New design features contribute to more efficient operation. Rapid selection of speeds and feeds, easy adjustment of cutters, easy and positive control of infeed, are examples.

And the accuracy inherent in the Farrel-Sykes process of gear generation assures accurate tooth spacing, profile and helix angle. The gears you make will operate smoothly, quietly and efficiently for many years to come.

The "Twin-Head" generator cuts all types of herringbone gears, single helical and spur gears, two members of a cluster gear simultaneously, and other toothed and cylindrical forms.

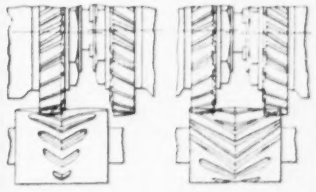
Ask for bulletin T-455.

FARREL-BIRMINGHAM COMPANY, INC., ANSONIA, CONN.

Plants: Ansonia and Derby, Conn., Buffalo, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Cambridge (Mass.), Akron, Cleveland, Chicago, Los Angeles, Houston

Farrel-Birmingham ®

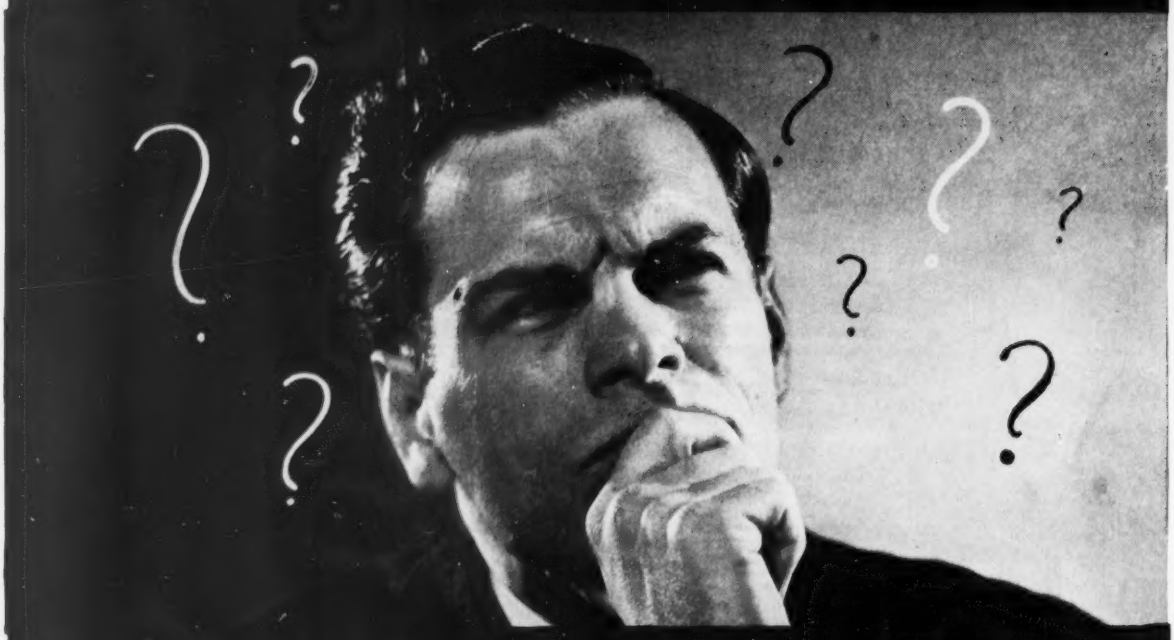
FB-935



PRECISION GENERATION

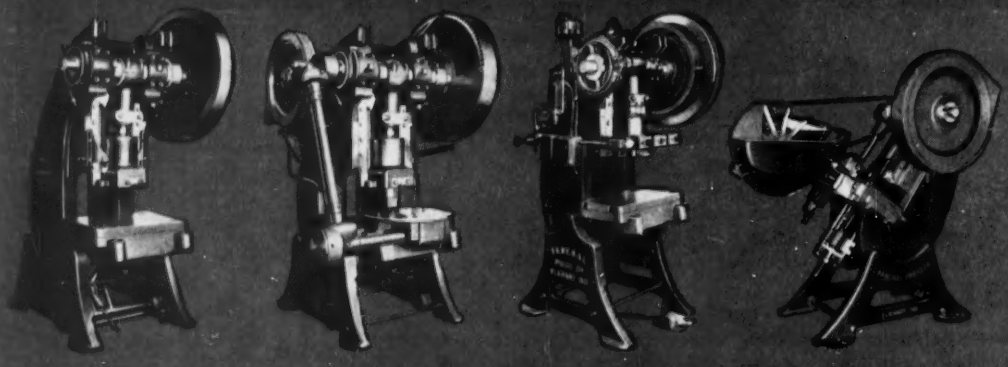
The Farrel-Sykes gear machine is equipped with two cutters mounted on a single carriage. The cutters reciprocate, each ending its stroke at the center of the blank. As they cut, they rotate to generate the helices and also slowly revolve in unison with the gear blank to generate the tooth contours precisely.

GOT PRESSROOM PROBLEMS?



Solve 'em with

FEDERAL *Open back Inclinable* PRESSES



STANDARD

Positive clutch. Safe, front-operated section. Non-repeat clutch. 18 to 60 ton capacities — geared and flywheel types.

DIAL FEED

Fast, accurate handling of many operations. Automatic safety stop. 18 to 60 ton capacities — geared and flywheel types.

HIGH SPEED

Air clutch with electro-pneumatic controls. Fingertip starting and stopping. Available in 18 to 60 ton capacities.

SPECIAL

Coppering, bolt trimming and extruding press. Available in 26 to 65 ton sizes. Special presses for automatic roll or pinch feeds.

Write for New Catalog No. 13 / **THE FEDERAL PRESS COMPANY,**

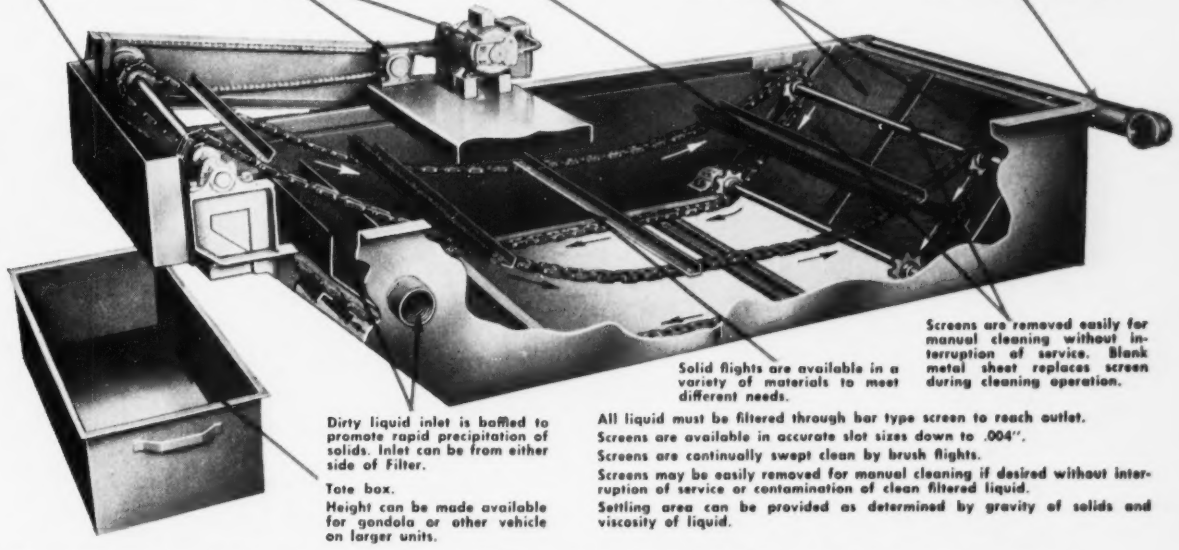
For more information on products advertised, use Inquiry Card, page 265

Another New Delpark *Development*

THE

Delpark COMBINATION Settling and Filter SYSTEM

FOR CONTINUOUS REMOVAL OF CHIPS, HEAVY SOLIDS AND RELATIVELY FINE SOLIDS TO .004" SCREENING


Special cleaning device (not shown) removes solids from flights prior to return.
Motor drive is through separate reduction gears. May be mounted on either side as desired.
Screen is continuously swept clean with specially constructed brush flights.
To reach outlet all liquid must pass through bar type screen with accurately sized slots. Screens available with slots down to .004" in size.
Clean liquid outlet following flow through bar type, continuously cleaned screen.
Clean liquid discharge can be from either side of Filter.
Screens are removed easily for manual cleaning without interruption of service. Blank metal sheet replaces screen during cleaning operation.
Solid flights are available in a variety of materials to meet different needs.
Dirty liquid inlet is baffled to promote rapid precipitation of solids. Inlet can be from either side of Filter.
Tote box.
Height can be made available for gondola or other vehicle on larger units.

All liquid must be filtered through bar type screen to reach outlet.
Screens are available in accurate slot sizes down to .004".
Screens are continually swept clean by brush flights.
Screens may be easily removed for manual cleaning if desired without interruption of service or contamination of clean filtered liquid.
Settling area can be provided as determined by gravity of solids and viscosity of liquid.

The DELPARK Settling and Filter System is engineered for the filtration of particles .004" or larger. It is made for the filtration of liquids of varying degrees of viscosity containing solids of different particle sizes and widely differing weights. Size of the equipment is dependent upon the settling rate which in turn is governed by the gravity of the solids and the viscosity of the liquid. This factor determines the retention period for a given rate of flow.

Write today for more information on this newest development in DELPARK Industrial Filtration.

Delpark INDUSTRIAL FILTRATION

BACKED BY MORE THAN 30 YEARS EXPERIENCE IN INDUSTRIAL FILTRATION

INDUSTRIAL FILTRATION COMPANY, 15 INDUSTRIAL AVENUE, LEBANON, INDIANA

Meet "The Man in
C. P. Looney
P. Slivinski
A. T. Warren
D. L. George
J. Grenier
M. M. Chatfield
J. W. George
C. Ransow
D. R. Campbell
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Stuart's
CUTTING FLUIDS
AND LUBRICANTS
More than a "Coolant" is Needed

the Barrel"

. . . CONSULTANT ON INDUSTRIAL LUBRICATION PROBLEMS . . .

He's experienced, qualified . . . he knows how to solve industrial lubrication problems. Back of him is Stuart's research laboratory, one of the finest in the country exclusively devoted to industrial lubrication problems. Here, men are constantly at work developing new products and improving established ones so that Stuart customers are assured the best possible results . . . *greater production, improved surface finishes and longer tool life.*

Stuart products "The Man in the Barrel" sells include straight oil type cutting and grinding fluids, water-mix cutting and grinding fluids, drawing and stamping compounds and lubricating oils and greases for gears, bearings and machine tool ways. The next time you have an industrial lubrication problem, contact "The Man in the Barrel." With almost 90 years specialized company experience behind him, he's your best guide to the *right* oil for your job to *save you time, money and material.*

THE
Stuart
TRIANGLE
Represents the pooling of experience, and information from Stuart's laboratory, field men and customers to assure the selection of the right lubricant to do the best job!

D.A. Stuart Oil CO.
EST 1865 LIMITED

TIME-TESTED CUTTING FLUIDS AND LUBRICANTS

2739 S. Troy St., Chicago 23, Illinois

In Canada: Canadian D. A. Stuart Oil Co., Ltd., 3575 Danforth Ave., Toronto

A quick guide to starting recommendations for any job

CLIP TO YOUR COMPANY LETTERHEAD AND MAIL TO

D. A. Stuart Oil Company
2739 S. Troy Street, Chicago 23, Illinois

☐ Please have "the Man in the Barrel" call.

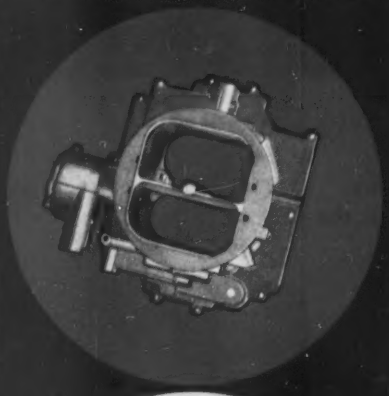
☐ Please send Cutting and Grinding Fluid Selector and Dilut-O-Graph Folder.

Name_____

Title_____

DRILL-SPOT FACE-COUNTERSINK-REAM-TAP

20
individual operations



...on one Part
...on one Machine
...in ten Seconds!

...that's precision production on a **Morris**
MOR-SPEED Machine

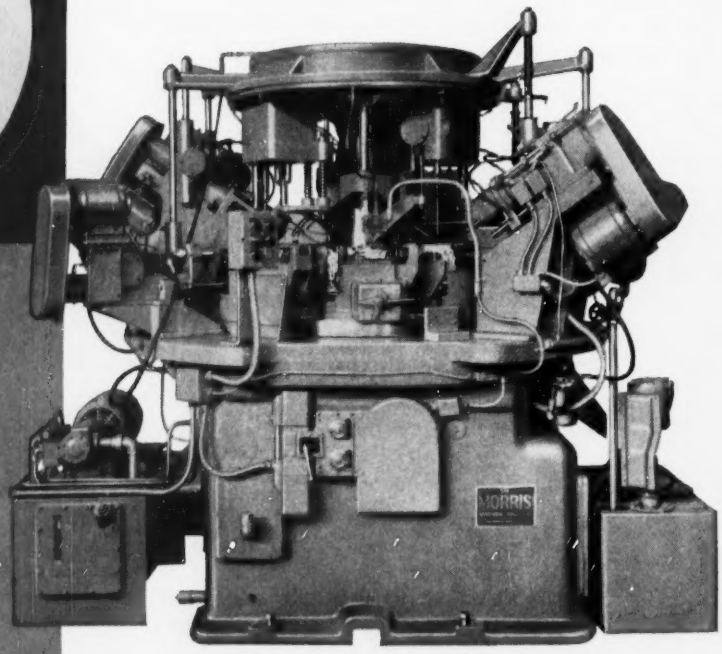
a better product at less cost with precision PLUS production

It's easy to say "the way to higher production and lower costs lies in special machinery." The sky-high price and limited application of a "special" often makes this solution impractical.

But Morris Engineers have developed a time-tested method for delivering precision production at lowest cost . . . *without* a staggering investment. Morris MOR-SPEED Machines combine *standard* machine units in a special design that offers all the advantages of "special machinery" without the big price tag.

The machine illustrated is a good example: standard base, standard indexing table, standard center column, standard straight and angular drilling heads, standard coolant and hydraulic units plus a minimum of special tooling. The result is "special" machine production at a very special, low cost.

Your drilling, tapping, reaming and similar operations may be adaptable to a MOR-SPEED solution. It costs you nothing to find out! *Write today for complete details.*



Morris

THE MORRIS MACHINE TOOL CO.
946 HARRIET ST., CINCINNATI 3, OHIO

For more information on products advertised, use Inquiry Card, page 265

National Tool Co.

Years of successful experience in special tooling and related production problems are yours for the asking. When the job requires special cutting tools call in your National Tool Co. representative. He is backed by more than 49 years experience in the engineering and manufacture of special cutting tools. His assistance is yours, without obligation, whether you're interested in one tool or a complete tooling program.

National Tools Cleveland

National
TOOL CO.
Cleveland 2, Ohio

Product Directory

To find headings easily, look for capital letters at top of each page to denote locations.

ABRASIVE CLOTH, Paper and Belt
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

ABRASIVES
See Discs, Abrasive

ABRASIVES, HONING
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

ABRASIVES, Polishing, Tumbling, Etc.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

ACCUMULATORS, Hydraulic
American Steel Foundries, Elmes Engineering Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.

How SUNDSTRAND Hydraulic Division Uses CLEVELAND Electronic Gages To Maintain Accuracy in Production

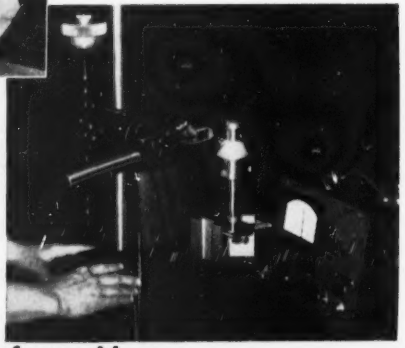
HYDRAULIC motors, transmissions and pumps are among the products of Sundstrand Machine Tool Co.'s Hydraulic Division, Rockford, Ill. Components are held to tolerances as close as 0.000050".

To make sure of the required precision, Sundstrand uses Cleveland electronic gaging equipment as shown below for checking gage blocks, master gages, production gages and tool setups. J. B. Gehlhausen, Foreman of Tool and Gage Inspection, reports that Cleveland gages are consistently accurate, easy to read, and can be set up or changed over in a minute or two.

Checking gage blocks to 0.000001" for size and parallelism at Sundstrand's Hydraulic Division, using Cleveland MICRO-AC Electronic Microcomparator. Every gage block in the plant is checked annually this way; and all replacement gage blocks are given the same inspection. The standard MICRO-AC reads 0.000010" or 0.000001" per scale division, as selected by a knob on the amplifier panel.

Sundstrand's master and production plug gages are regularly checked with a PAR-AC electronic gage as shown; and all new plug gages are inspected upon receipt. High-speed meter shows deviations from nominal size in increments of 0.0001" or 0.000010" per scale division.

Checking distance between two boring tool bits with INDI-AC Electronic Indicator in Sundstrand's Tool and Gage Inspection Department. This company uses the INDI-AC for all types of surface plate work.



More and more users find, like Sundstrand, that Cleveland electronic gaging equipment offers an unusually useful combination of operating features. Want details? Write for illustrated bulletins.

Designed, developed and manufactured by

Cleveland INSTRUMENT CO.
735-2 CARNEGIE AVE. CLEVELAND 15, OHIO

Baldwin-Lima-Hamilton Corp., Philadelphia, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Farquhar, A. B., Div. Oliver Corp., 142 North Duke St., York, Pa.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Morgan Engineering Co., Alliance, Ohio
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wood & Co., R. D., Public Ledger Bldg., Philadelphia, Pa.

AIR HOISTS—See Hoists, Air.

AIR TOOLS—See Grinders, Pneumatic; Drills, Portable Pneumatic, Etc.

ALLOY STEELS
Allegheny Ludlum Steel Corp., Pittsburg, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Lincoln Hwy. & State St., Chicago Heights, Ill.
Crucible Steel Co. of America, Chrysler Bldg., New York 1, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Union Drawn Steel Div., Republic Bldg., Cleveland, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

ALLOY STEELS, High Temperature
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.

ALLOYS, Non-Ferrous
American Brass Co., 25 Broadway, New York.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

ALLOYS, Zinc
New Jersey Zinc Co., 160 Front St., New York, N. Y.

ARBOR PRESSES
See Presses, Arbor

ARBORS AND MANDRELS
Amco Gage Co., 19760 W. 8 Mile Rd., Detroit 19, Mich.
Beaver Tool & Engineering Corp. (Arbors only), 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
Jacobs Mfg. Co., West Hartford, Conn.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Keo Cutters, 19326 Woodward, Detroit, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.

(*Continued on page* 306)

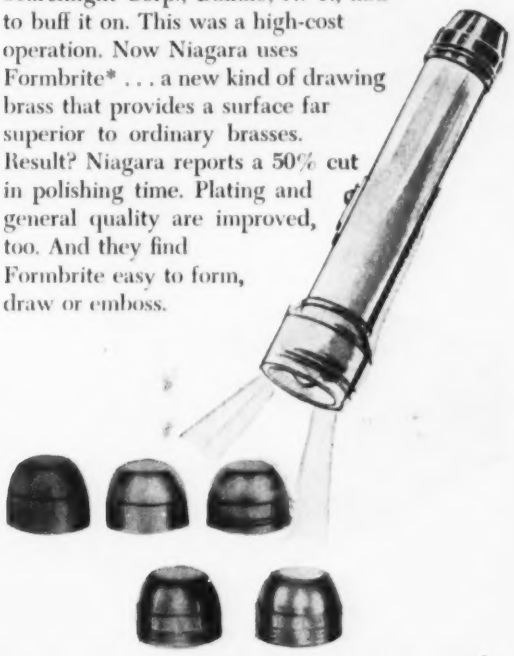
For more information on products advertised, use Inquiry Card, page 265

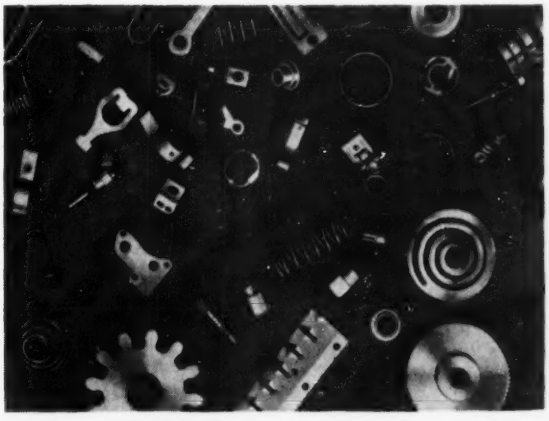
ANACONDA METALS AT WORK

The American Brass Company develops a new kind of brass that cuts polishing time 50% for one manufacturer and improves product appearance for another... makes bronzes that extend the life of many metal parts

Spotlight on high luster at low cost

The high luster on these brass flashlight end caps didn't come naturally. Niagara Searchlight Corp., Buffalo, N. Y., had to buff it on. This was a high-cost operation. Now Niagara uses Formbrite* . . . a new kind of drawing brass that provides a surface far superior to ordinary brasses. Result? Niagara reports a 50% cut in polishing time. Plating and general quality are improved, too. And they find Formbrite easy to form, draw or emboss.





Old age insurance...

It's easy to take out. And you pay no premium. All you do is specify ANACONDA Phosphor Bronze for the many components like those shown. Ten alloys are available in seven forms. All are strong and tough. They bear up under constant wear and flexings, periodic stresses, fatigue and corrosion. They resist abrasion . . . conduct heat and electricity well . . . keep their high elasticity. We'll be glad to help you select the Phosphor Bronze Alloy that's just right for your job.

What's in a nameplate?

According to the Arlen Trophy Co., Brooklyn, N. Y., one of the largest trophy and premium manufacturers in the country, the *appearance* of a nameplate often means the difference between landing or losing a sale. But price is important, too. That's why Arlen now makes their nameplates out of Formbrite. It costs no more than ordinary brasses. Yet, because of its superfine grain structure, it polishes to a bright finish in half the time. Formbrite results in harder, stronger, springier, more scratch-resistant products, too.

6402

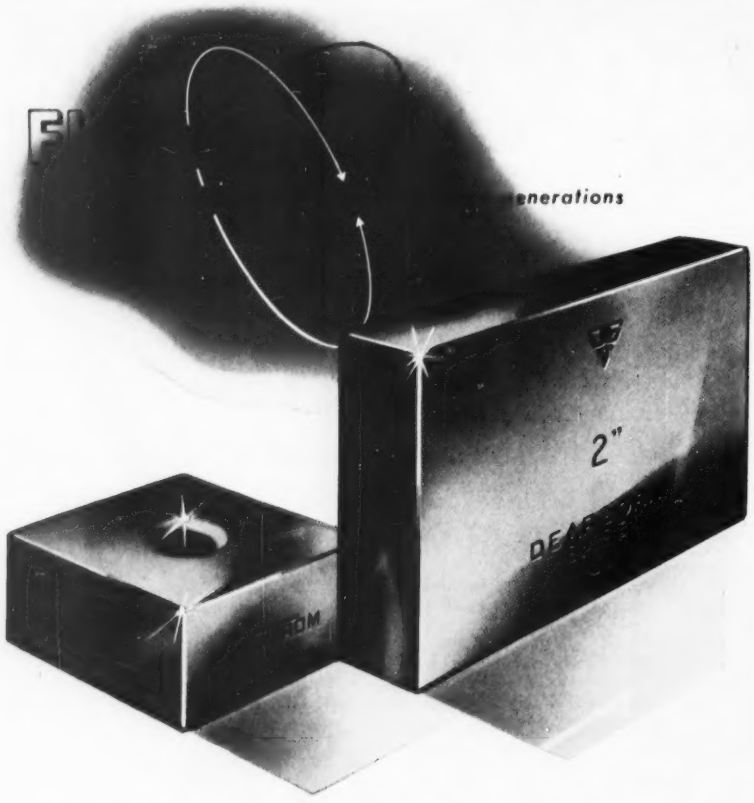
Want more information?

Our Technical Department can give you a wealth of information on the properties and applications of Formbrite and Phosphor Bronze. Write to: *The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.*

*Reg. U. S. Pat. Off.

ANACONDA®

the name to remember in COPPER • BRASS • BRONZE



No finer GAGE BLOCKS at any price!

By any comparison you care to make . . . block-for-block, set for set . . . you'll find Ellstrom Chromium Plated Standards truly outstanding in the field of precision measurement. Materials used in their manufacture are precisely treated and thoroughly tested for coefficient of expansion, uniform hardness, and metallurgical stability. The durable chromium plated gaging surfaces are applied and finished by special Ellstrom methods which assure you of greater serviceability, longer wearing millionths. And flatness, parallelism, and specified accuracy of each individual block is fully certified by the most uncompromising final inspection found anywhere in the industry.

So next time you need gage blocks, specify Ellstrom Standards. Furnished in 28 basic sets, either square or rectangular styles, with block sizes in step series from .010" up to and including 20.000". Basic accessories also available . . . plus tungsten carbide wear blocks and individual blocks to meet your specific requirements.

IF YOU BUY GAGE BLOCKS, you should have this handy new Ellstrom Standards Catalog. Contains complete specifications and prices in convenient tabular form . . . and a copy is yours for the asking. Send for it today!

ELLSTROM STANDARDS DIVISION
Dearborn Gage Company • 22035 Beech Street • Dearborn, Mich.
Originators of Chromium Plated Gage Blocks

REPRESENTATIVES IN PRINCIPAL CITIES THROUGHOUT THE UNITED STATES AND CANADA

Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Supreme Products, Inc., 2222 So. Calumet, Chicago 16, Ill.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

BABBITT

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

BALANCING EQUIPMENT

Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Casa Corp., 405 Lexington Ave., New York 17.
Gisholt Machine Co. (Static and Dynamic), 1245 E. Washington Ave., Madison 10, Wis.
Keller Tool Co., Grand Haven, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Olsen, Tinius, Testing Machine Co., Philadelphia, Pa.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pope Machinery Corp., Haverhill, Mass.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mich. Tool Co., 2531 11th St., Rockford, Ill.

BALLS

Kennametal, Inc., Latrobe, Pa.

BARS, Phosphor Bronze

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.

BARS, Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Lincoln Hwy. & State St., Chicago Heights, Ill.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Union Drawn Steel Div., (Cold Drawn), Republic Bldg., Cleveland, Ohio.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

BASES, Machinery Welded

Mahon, R. C., Co., 6565 E. 8 Mile Rd., Detroit 34, Mich.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.

BEARINGS, Babbitt

Bunting Brass & Bronze Co., Spencer and Carlton Ave., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.
Link-Belt Co., 2410 W. 18th St., Chicago 8, Ill.

BEARINGS, Ball

Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Fafnir Bearing Co., New Britain, Conn.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
New Departure Div., General Motors, Bristol, Conn.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Torrington Co., Torrington, Conn.

(*Continued on page* 310)

For more information on products advertised, use Inquiry Card, page 265

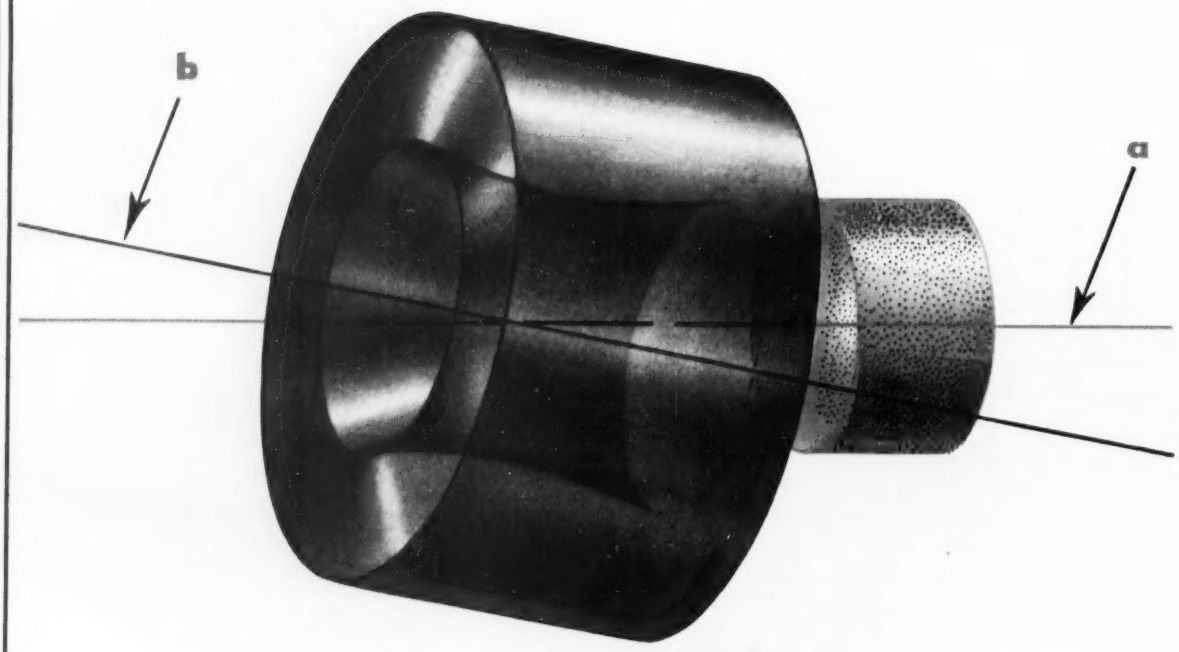
Jet Engines create *chucking* problems

The Cushman Chuck Company has engineered and designed an entirely new and tested approach to the problem of holding jet engine discs and rings. These new chucks have been developed in strict accordance with the principles of rapid-production techniques and chucking rigidity *without* distortion.

Designed for both hand and automatic chucking operations. Engineered to your requirements.

THE CUSHMAN CHUCK COMPANY
815 WINDSOR STREET
HARTFORD 2, CONNECTICUT

A WORLD STANDARD FOR PRECISION

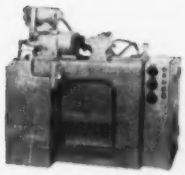


misalignment is expensive

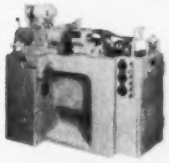
...Bryant controlled alignment

BELL mouth holes are a common internal grinding error. General available information advises simply turning the workhead or changing the length of traverse to correct this error, to generate a straight hole. In the case illustrated above, where bell mouth exists on both ends of the hole, either turning the workhead or changing the length of stroke will improve the shape of the hole but will not correct the error. In the illustration, the work axis "b" is tipped out of alignment with wheel and wheel path axis "a". When the wheel, moving on axis "a", traverses the front of the hole, it grinds above the work center line and the front of the hole will be oversize. As the wheel traverses the center of the hole, the hole

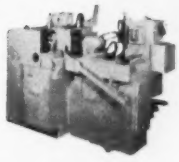
Write for "Alignment" booklet which gives complete details on this interesting subject. Also ask for booking form on new sound, color movie—free showings arranged for engineering groups.



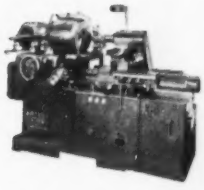
no. 1109 9″ swing, semi-automatic



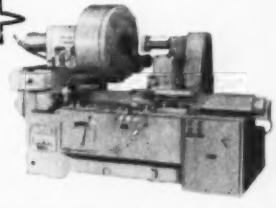
no. 1309-W 9″ swing, 2 spindle semi-automatic



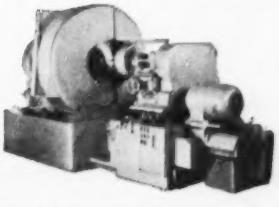
no. 2209 9″ swing, automatic



no. 1116 16″ swing, semi-automatic



no. 1130 30″ swing, semi-automatic



no. 1460 60″ swing, semi-automatic

The Bryant 1130 Hydraulic Internal Grinder is a heavy-duty semi-automatic machine designed to handle a wide variety of work with minimum time and effort. The 30″ swing permits grinding of straight and tapered holes in large diameter work to a maximum depth of 12″. The workhead can be swiveled to grind tapers up to 15° included angle. The workslide is mounted on preloaded balls to provide rigid and sensitive control. The left end may be raised or lowered to bring its axis into a plane parallel with the wheel path. Stable three point support is provided under the wheelslide and this, too, may be adjusted to insure straight line motion of the wheel. The Bryant 1130 has an extremely rugged bed to meet the requirements of heavy work. Coolant and hydraulic tanks are separate from the bed. Write for folder.

gives better internal grinding

will be smaller. As the wheel traverses the back of the hole, it grinds below the center line and the hole will again be oversize. While the wheel contact may be a full line, it will not be parallel to the axis of the work.

The only possible remedy is to correct the alignment of the workhead axis "b" so that it will be parallel with the wheel and wheel path axis "a". Wheel wear will be uniform but, most important, the geometry of the hole will be correct.

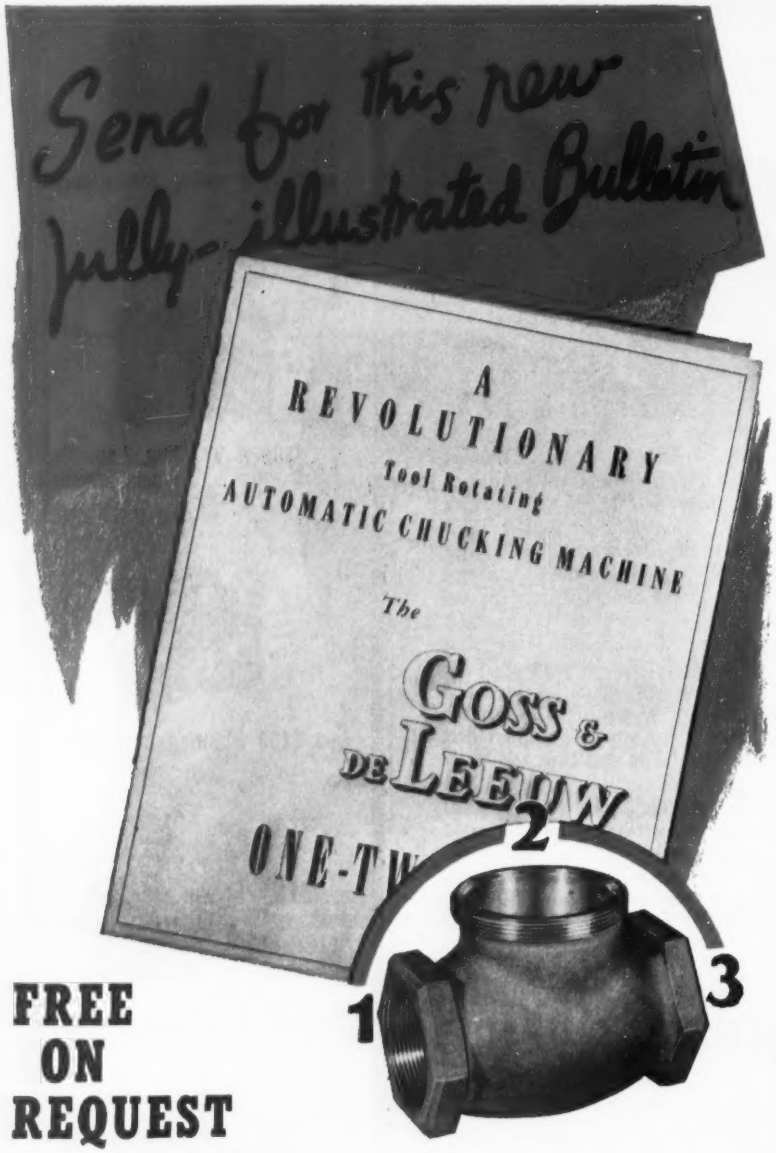
Bryant internal grinders are engineered to permit adjustment which will bring the workhead into proper alignment.

see our catalog in MACHINE TOOL CATALOGS or write for copy

Bryant Chucking Grinder Co.

Springfield, Vermont, U. S. A.

Internal Grinders • Boring Machines • Internal & External Thread Gages • Granite Surface Plates



FREE ON REQUEST

Here are the answers to most of your questions as to what "ONE-TWO-THREE" means in describing this outstanding development of Automatic Chucking Machines by Goss and De Leeuw. You'll be interested not only in the revolutionary design of the machine itself, but also in its extraordinary performance—and how it is possible to handle from one to three operations—in sequence or simultaneously without changing set up.

Get this interesting, informative Bulletin NOW—by merely asking for it.

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

BEARINGS, Bronze and Special Alloy
Bunting Brass & Bronze Co., Spencer & Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Johnson Bronze Co., New Castle, Pa.
Link-Belt Co., 2410 W. 18th St., Chicago 8, Ill.

BEARINGS, Lineshaft
Fafnir Bearing Co., New Britain, Conn.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Orange Roller Bearing Co., Inc., Orange, N. J.
Standard Pressed Steel Co., Jenkintown, Pa.

BEARINGS, Needle
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Orange Roller Bearing Co., Inc., Orange, N. J.
Torrington Co., Torrington, Conn.

BEARINGS, Roller
Ball & Roller Bearing Co., Danbury, Conn.
Fafnir Bearing Co., New Britain, Conn.
Hyatt Bearings Div., Harrison, N. J.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearings Co., Inc., 541 Seymour St., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.
Torrington Co., Torrington, Conn.

BEARINGS, Self-Lubricating (Oilness)
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.

BEARINGS, Tapered Roller
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Timken Roller Bearing Co., Canton, Ohio.
Torrington Co., Torrington, Conn.

BEARINGS, Thrust
Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Fafnir Bearing Co., New Britain, Conn.
General Electric Co., Schenectady, N. Y.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearing Co., Inc., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.
Torrington Co., Torrington, Conn.

BELT SHIFTERS
Standard Pressed Steel Co., Jenkintown, Pa.

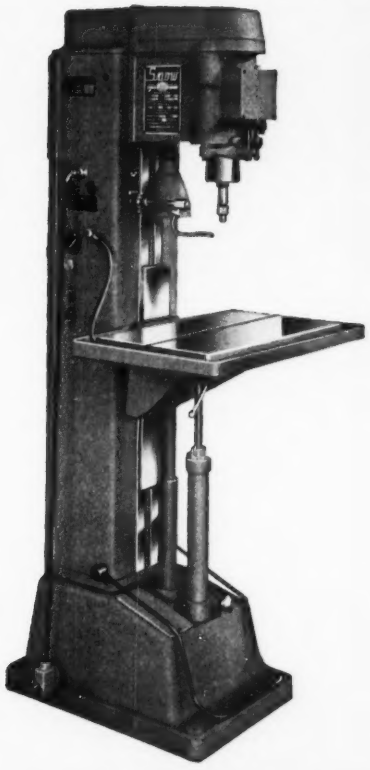
BELTING, TRANSMISSION
Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.

(*Continued on page* 312)

For more information on products advertised, use Inquiry Card, page 265

SNOW MANUFACTURING COMPANY

455 EASTERN AVENUE • BELLWOOD, ILLINOIS



FULL UNIVERSAL MACHINES

Electrically Operated—Air Controlled

...Drilling—TYPE "UD"

Capacities from #60 through 3/8" in two sizes

...Tapping—TYPE "UT"

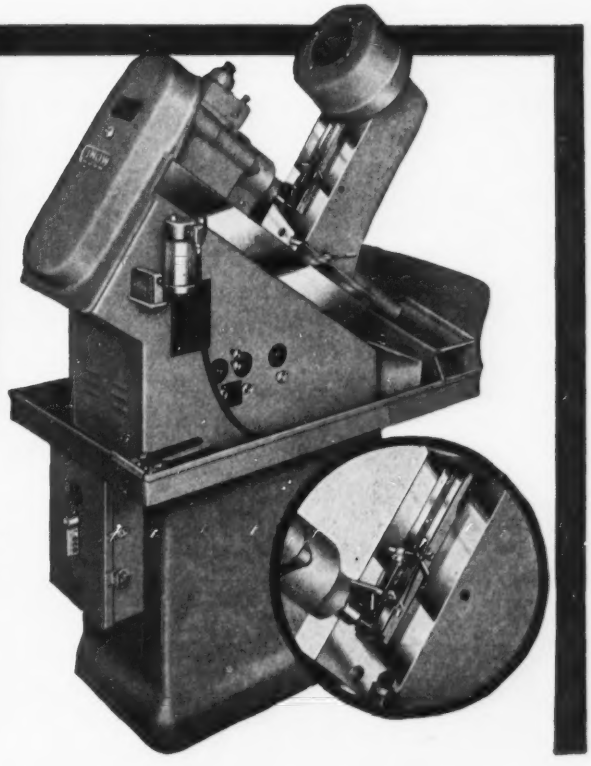
Capacities from #0 through 3/4" in four sizes

...Threading—TYPE "TR"

Capacities up to 1" in two sizes

AUTOMATIC and SEMI-AUTOMATIC JIGS and FIXTURES for Indexing and Clamping

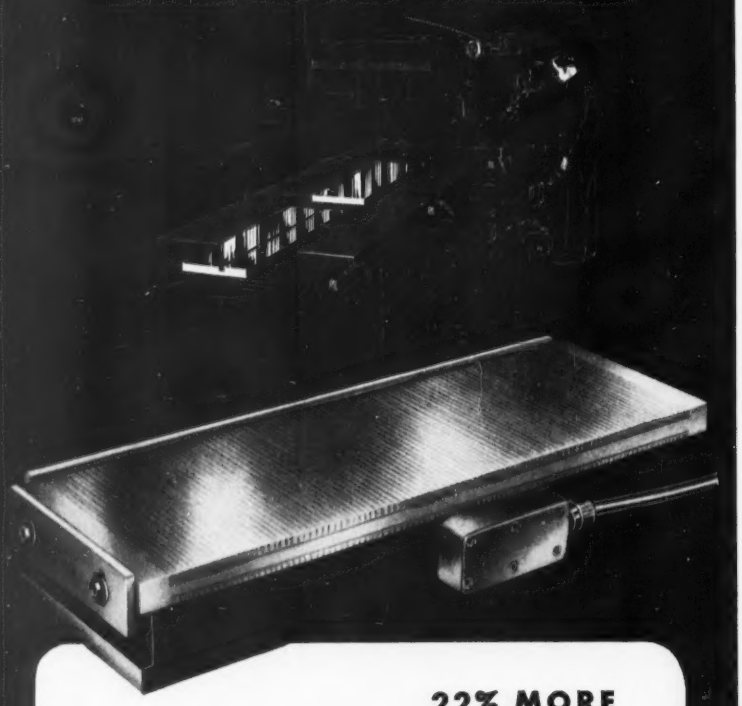
A complete line of basic Master Fixtures to permit adaptation of a wide range of parts at high production rate with low tooling cost.



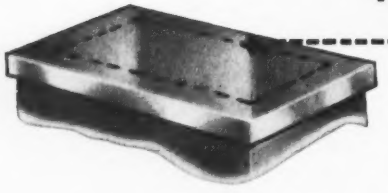
FULL AUTOMATIC *Nut Tapping Machines*

Completely automatic hopper feed nut tapping machines up to 5/8"—incorporating simplicity and low tooling cost. Standard taps are used. Precision class 3 and 4 fits and parallelism maintained at high speed and high production.

Magna-Lock
ELECTRO-MAGNETIC
CHUCKS HOLD



22% MORE HOLDING AREA



Fine poles permit holding small work pieces, too.

This extra margin of holding power holds an extra margin of profit for you!

Get details, DEPT. M-74

Request Magna-Lock as original equipment on your new machines

Hanchett MAGNA-LOCK CORPORATION
Magnetic Chucks and Devices
BIG RAPIDS, MICHIGAN, U. S. A.

BENCHES, Work, and Bench Legs
Standard Pressed Steel Co., Jenkintown, Pa.

BENDING MACHINES, Angle Iron, Plate, Etc.
Consolidated Mch. Tool Corp., 565 Blossom Rd., Rochester, N. Y.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.

BENDING MACHINES, Hydraulic
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Farquhar, A. B., Div. Oliver Corp., 142 North Duke St., York, Pa.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 30 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Morgan Engineering Co., Alliance, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wood & Co., R. D., Public Ledger Bldg., Philadelphia, Pa.

BENDING MACHINES, Pipe
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Farquhar, A. B., Div. Oliver Corp., 142 North Duke St., York, Pa.
Watson-Stillman Co., Div., H. K. Porter Co., Inc., Roselle, N. J.

BLAST CLEANING EQUIPMENT
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Pangborn Corp., Hagerstown, Md.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

BLOWERS
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

BLUING LAYOUT
Dykem Co., 2303 P. N. 11th St., St. Louis 6, Mo.

BOILER TUBES
Bethlehem Steel Co., Bethlehem, Pa.
Republic Steel Corp., Steel and Tubes Div., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

BOLT AND NUT MACHINERY
Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
New Britain Machine Co., New Britain-Gridley Mch. Div., New Britain, Conn.

BOLTS AND NUTS
Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only)
Bethlehem Steel Co., Bethlehem, Pa.
Elastic Stop Nut Corp., 2330 Vauxhall Rd., Union, N. J.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Ottemiller, W. H., & Co., York, Pa.
Republic Steel Corp., Bolt & Nut Div., Republic Bldg., Cleveland 1, Ohio.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.

BOLTS, T-Slot
O. K. Tool Co., Milford, N. H.

(*Continued on page* 314)

For more information on products advertised, use Inquiry Card, page 265

Avey announces . . . A unique Indexing Machine

It's NEW!

A really great advance in the automatic drilling machine industry!

ELECTRODEX

Machine Indexes from precision templates which may be changed in a matter of minutes.

Index Pattern may also be changed by Push Button Control.

Index templates, inexpensive, with immediate delivery.

Designed primarily for the Jet Engine Industry.

May be used on any Multiple Indexing arrangement where indexing patterns are complex.

Can be used on Drilling, Tapping, Milling, etc.

As many as three different hole patterns may be drilled by push button control without any relocation of part.

No hydraulics or Geneva Mechanism used.

Table actuated by standard D. C. Motor and simplified control panel using all standard electrical components employing line voltage. Conforms to J.I.C. Standards.

2-200 Indexes.

Even or uneven Indexes.

Push Button Control

Extreme Index Accuracy to .001.

30-36" Diameter

Built-in checking device.

A special machine with STANDARD machine flexibility.

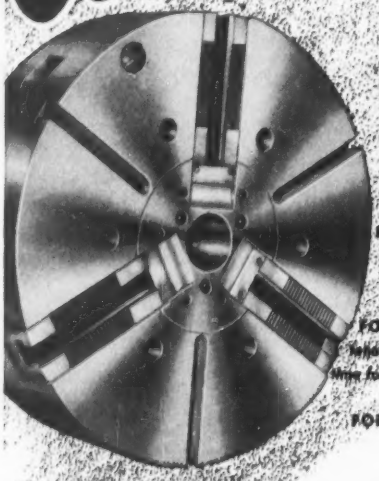
Avey

Patent Pending

THE AVEY DRILLING MACHINE CO. Cincinnati 1, Ohio

Whiton

AIR CHUCKS



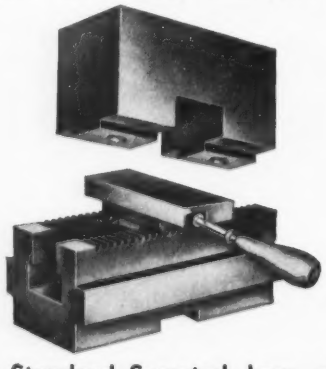
Equipped with American Standard Serrated Jaws and Whiton Micro Jaw-Set.

FOR INCREASED PRODUCTION with less operator fatigue. Faster spindle speeds with safe, fast chucking of work.

FOR PRECISION ADJUSTMENT of chuck jaws. Maintenance of jaw settings during long runs. Less down time for adjustment.

FOR STANDARDIZED WORK-HOLDING EQUIPMENT

Whiton Air Chucks are engineered to give maximum efficiency and economy of operation. Sizes up to 12" are wedge-actuated for high speed spindle rotation. Larger sizes up to 36" are lever-actuated to give maximum holding power with minimum air consumption. Chuck body and jaws are made of selected steels and heat treated for strength and durability.



Whiton MICRO JAW-SET

An exclusive Whiton feature which, in combination with the American Standard Serrated Jaws, gives Whiton Chucks the rigidity of a non-adjustable chuck and provides for extremely precise individual jaw adjustment.

Whiton SINCE 1856

BOOKS, Technical

Industrial Press, 148 Lafayette St., New York 13, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.

BORING AND DRILLING MACHINES

Baker Bros., Inc., Sta. F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Canedy-Otto Div. Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.

BORING AND TURNING MILLS, Vertical

American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

BORING BARS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Homestrand Inc., Larchmont, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BORING, DRILLING AND MILLING MACHINES, Horizontal
(Floor, Planer or Table Types)

Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn. R. R., Evanston, Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5 Ind.

(*Continued on page* 316)

For more information on products advertised, use Inquiry Card, page 265

NOW...*a new addition to the famous* **HANSON** *processes*

HANSON-WHITNEY

Internal Thread Comparator for VISUAL GAGING

fast·accurate·economical

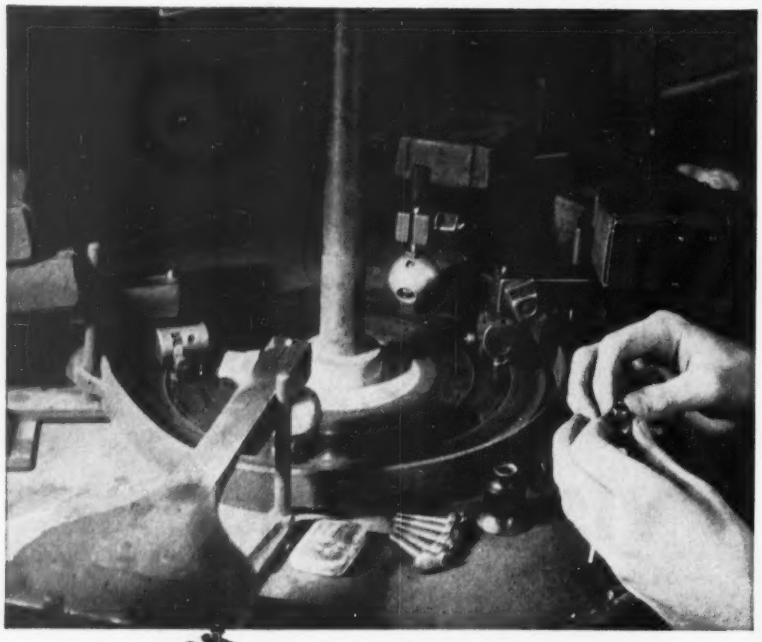
This new Hanson-Whitney Internal Thread Comparator provides fast, accurate, economical, visual gaging of all forms and classes of internal threads in diameters ranging from ⅜" to 1½". Thread segments are quickly interchangeable for inspecting other types, sizes and forms of threads. Accumulated errors of lead and pitch diameter can be analyzed by using the H-W Comparator with special two-thread segments.

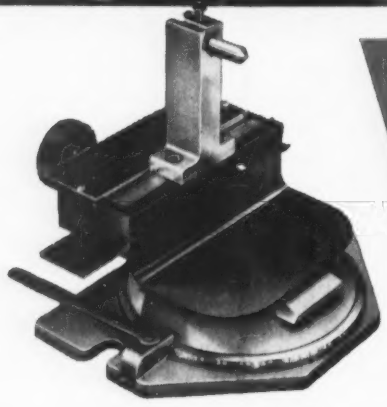
Recognized Hanson standards of quality are embodied in the new H-W Internal Thread Comparator. All movable parts are hardened, ground and lapped to precision tolerances—thread segments will outlast several plugs. Exclusive actuating principle insures long-life accuracy.

Your nearest Hanson-Whitney representative will gladly show you how to reduce your gaging costs with the new Hanson-Whitney Internal Thread Comparator.

HANSON-WHITNEY COMPANY
Division of Whitney Chain Company, Hartford 2, Connecticut, U. S. A.

the **HANSON**
Threading Processes
Offer Complete
Coordinated
Responsibility
for
The Machine Tools
The Cutting Tools
The Measuring Gages





A Specialist is Your Best Bet

The specialists who produce Vinco B-1 angle tangent to radius Dressers have skill and experience equal to that of industrial diamond cutters. The B-1 Dresser will dress contours on grinding wheels to an accuracy within .0001". This accuracy is assured for the life of the dresser by its good design, sturdy construction and anti-dust features. The B-1 Dresser can be used on surface grinders as well as internal, external, "multi-purpose" and tool and cutter grinders. Its accuracy and simplicity of operation take all of the "guess work" out of wheel dressing.

FREE! Send today for this booklet. It tells all about the B-1 Dresser . . . has tips on dressing angles tangent to radii.

VINCO CORP., 9113 Schaefer Hwy., Detroit 28, Mich.

Mass Produced Metal Component Parts • Aircraft and Commercial Gears • Master Gears • Spline Gages • Precisiondex • Gear Rolling Inspection Fixtures • Recording Camshaft Comparators • Optical Master Inspection Dividing Heads • Involute Checkers • Indicator Snap Gages.

VINCO ®

MILLIONTHS OF AN INCH FOR SALE

TRADEMARK OF DEPENDABILITY

Modern Ind. Engrg. Co. 14230 Birwood Ave., Detroit 4, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Orban Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.

BORING HEADS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5 Ind.
Mummert-Dixon Co., Hanover, Pa.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

BORING MACHINES

Bryant Chucking Grinder Co., Springfield, Vt.
Chandler Tool Co., 514 Ohio Ave., Muncie, Ind.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Heald Machine Co., 10 New Bond St. Worcester 6, Mass.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5 Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Simplex Machine Tool Corp., 4528 W. Mitchell St., Milwaukee, Wis.

BORING MACHINES, Jig

American Sip Corp., 100 E. 42nd St., New York 17, N. Y.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc. 200 Lafayette St., New York 12, N. Y.

BORING TOOLS

American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Atrax Co., Newington, Conn.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit, Mich.
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Metal Carbides Corp., Youngstown, Ohio.

(*Continued on page 318*)

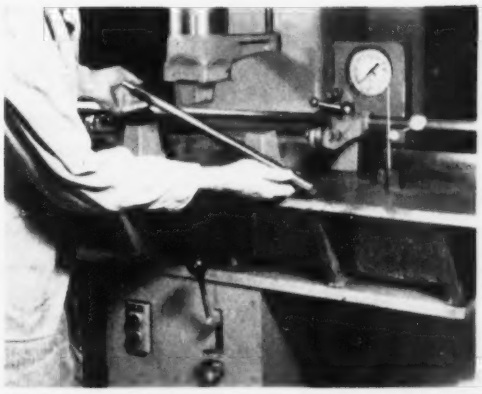
For more information on products advertised, use Inquiry Card, page 265

WITH HANNIFIN PRESSES

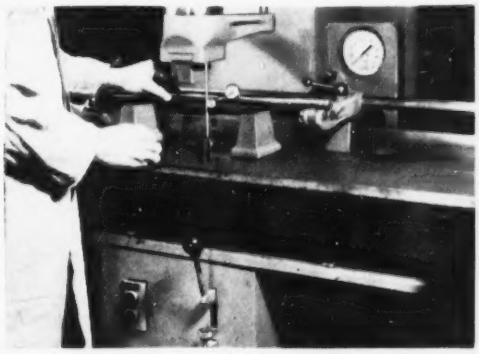
YOU STRAIGHTEN BY EYE!

HERE'S HOW AND WHY:

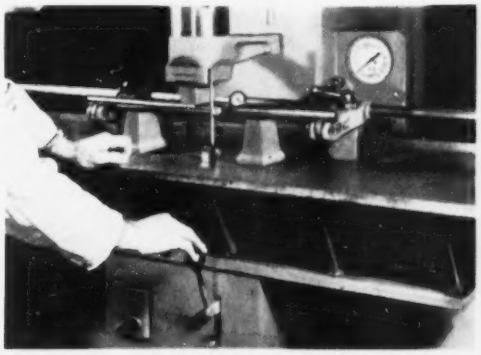
See how easy and quick straightening operations are with Hannifin Hydraulic Straightening Presses. The answer is Hannifin's exclusive, Sensitive Pressure Control . . . so sensitive that a touch of the finger causes the press to respond. With it an operator quickly becomes skilled at "straightening by eye." Ability to stop . . . re-start . . . or retract assures safety. Capacities to 150 tons. Investigate how to speed work . . . improve uniformity with Hannifin Straightening Presses. Hannifin Corporation, 1101 S. Kilbourn Ave., Chicago 24, Ill.



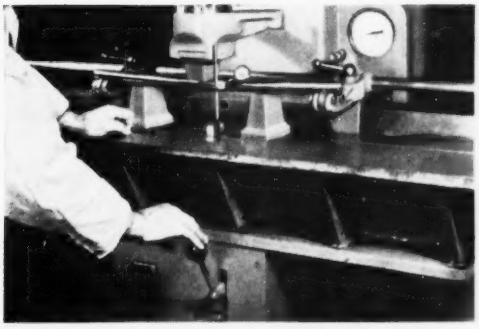
1. Rod to be straightened is placed in fixture on Hannifin 25-ton Straightening Press.* Centering fixture available.



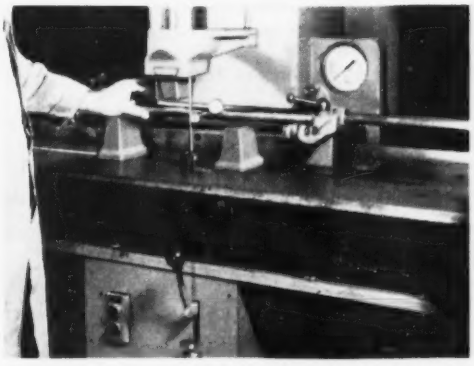
2. Operator rotates rod against deflection indicator. Dial reads .008 at point of maximum deflection.



3. Operator moves Sensitive Pressure Control slightly, ram moves down just enough to overcome springs of roller fixture and bring rod down on table blocks. (Note pressure gauge has barely moved off zero.)



4. Now operator "straightens by eye." Light finger touch bends rod just beyond yield point so it will take permanent "set" in desired direction. (Gauge shows press exerting force of 6 tons—but operator watches rod—not gauge.)



5. Sensitive Pressure Control is released and rod again rotated against indicator . . . deflection is .001, well within limits. Next piece!

NOTE: For simplicity, we have assumed that the operator got exactly the correction he needed on one try. While this often happens, the usual sequence is bend and try, bend and try. As you can see, however, successive bends can be made very quickly.

*While a much smaller press could be used for this particular job, notice how the extra sensitivity of Hannifin controls makes it possible to do a wide range of straightening work on a single press.

Hannifin Representatives Are at Your Service in These Leading Industrial Centers

Atlanta, Buffalo, Cincinnati, Cleveland, Dallas, Dayton, Denver, Detroit, Houston, Los Angeles, Milwaukee, Minneapolis, Moline, New Orleans, New York, Philadelphia, Pittsburgh, Richmond, Va.; Rochester, N. Y.; St. Louis, Seattle, South Bend, Ind.; Washington, D. C.; Worcester, Mass. In Canada, Tem Sales Co., Toronto & Windsor.

HANNIFIN

Hydraulic Presses • Pneumatic Presses • Hydraulic Riveters
Hydraulic Cylinders • Air Cylinders • Air Control Valves

WRITE FOR BULLETIN 130

Hannifin Corporation, 1109 S. Kilbourn Ave., Chicago 24, Illinois
Please send me Bulletin 130 on Hannifin Hydraulic Presses. I understand it includes information on Hannifin Straightening Presses.

Name.....

Position.....

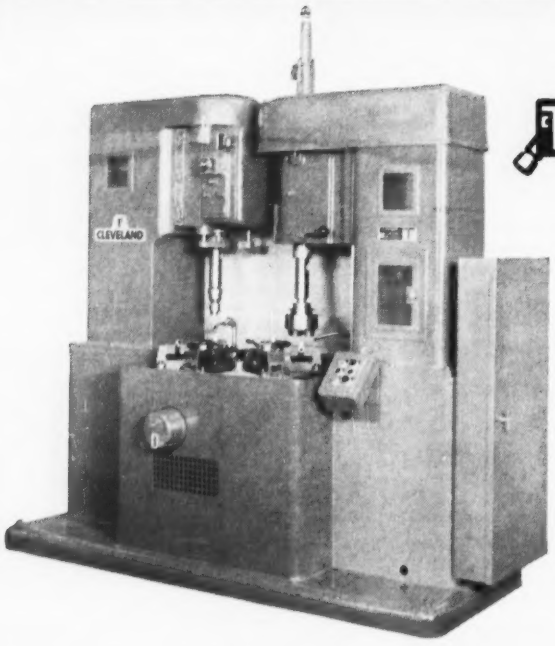
Company.....

Address.....

City.....*State*.....

For more information on products advertised, use Inquiry Card, page 265

Another Cleveland Design to Speed Production!



COMBINATION CLEVELAND REAMING AND THREADING MACHINE

PARTS: LB type fittings with external threads. Vapoil Connector Bodies 90°. Vapoil Connector Bodies straight.

MATERIAL: LB type fittings of Malleable Iron; other parts of cast aluminum.

A vertical combination machine consisting of a heavy duty Cleveland 21" Power Index Table, mounted on an all welded and normalized steel base with columns to support the machined units.

Send for your copy of this Guide

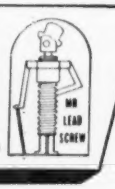
The tapping unit is Model E-3 Cleveland Lead Screw Production Tapping Head.

Mounted on top plate, six hand operated locating and clamping fixtures, with interchangeable jaw sets.

Write today for Catalog No. MY-74

CLEVELAND tapping machine co.

A Subsidiary of AUTOMATIC STEEL PRODUCTS, INC. • CANTON 6, OHIO



Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BRAKES, Press and Bending

Bliss E. W., Co., 1375 Raff Road, S. W., Canton, Ohio.
Cincinnati Shaper Co. Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

BROACHES

American Broach & Mch. Co., Ann Arbor, Mich.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

BROACHING MACHINES

American Broach & Mch. Co., Ann Arbor, Mich.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Foote-Burt Co., 130 St. Clair Ave., Cleveland 8, Ohio.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Wilson, K. R., 213 Mill St., Arcade, N. Y.
Zagar Tool Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

BRONZE

American Brass Co., Waterbury 20, Conn.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.
Mueller Brass Co., Port Huron 35, Mich.

BRUSHES, Industrial, Wire Wheel, Etc.

Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.

BUFFERS

Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md. (Portable Elec.).
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.

BULLDOZERS

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Atrax Co., Newington, Conn.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Hufford Machine Works, Inc. (Stretch-wrap) 1700 E. Grand Ave., El Segundo, Cal.
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.
Watson-Stillman Co., Div., H. K. Porter Co., Inc., Roselle, N. J.

(Continued on page 320)

For more information on products advertised, use Inquiry Card, page 265

The Geargrind Universal Oscillating Grinder will perform a wide range of grinding operations. Its initial cost is much lower than would be expected for a grinder with so many specialized uses.

Now...For toolroom or production work—a really versatile and rugged universal grinder

The Geargrind Universal Oscillating Grinder for Fine Finishing of Spherical–Conical–Cylindrical Surfaces

Whether you need tool room accuracy or production economy, you'll save time and money with the versatile Geargrind Universal Oscillating Grinder.

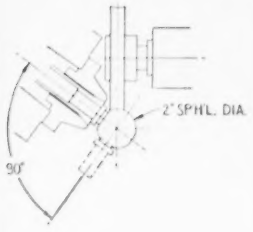
With its various simplified attachments, it is designed to perform *all* of these precision grinding jobs:

- internal and external cylindrical surfaces
- generated or formed spherical internal and external surfaces
- external conical surfaces
- internal tapers
- ball bearing races and fillets

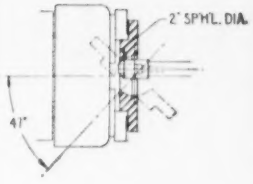
YOU'LL WANT ALL THE FACTS

We have prepared a comprehensive 6-page catalog on all the information and specifications of this unique grinder. Please write—we'll be happy to send it to you, along with a quotation of Geargrind's new low prices.

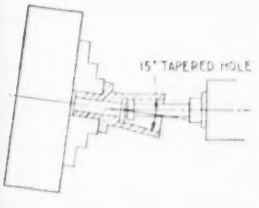
Typical examples of work performed on the Geargrind Universal Precision Grinder



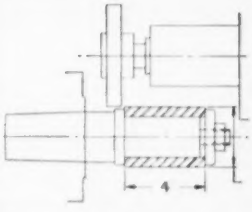
Ball stud, alloy steel, carburized and hardened. Held in a collet.



Flanged ball socket, cast iron. Held in a diaphragm chuck.



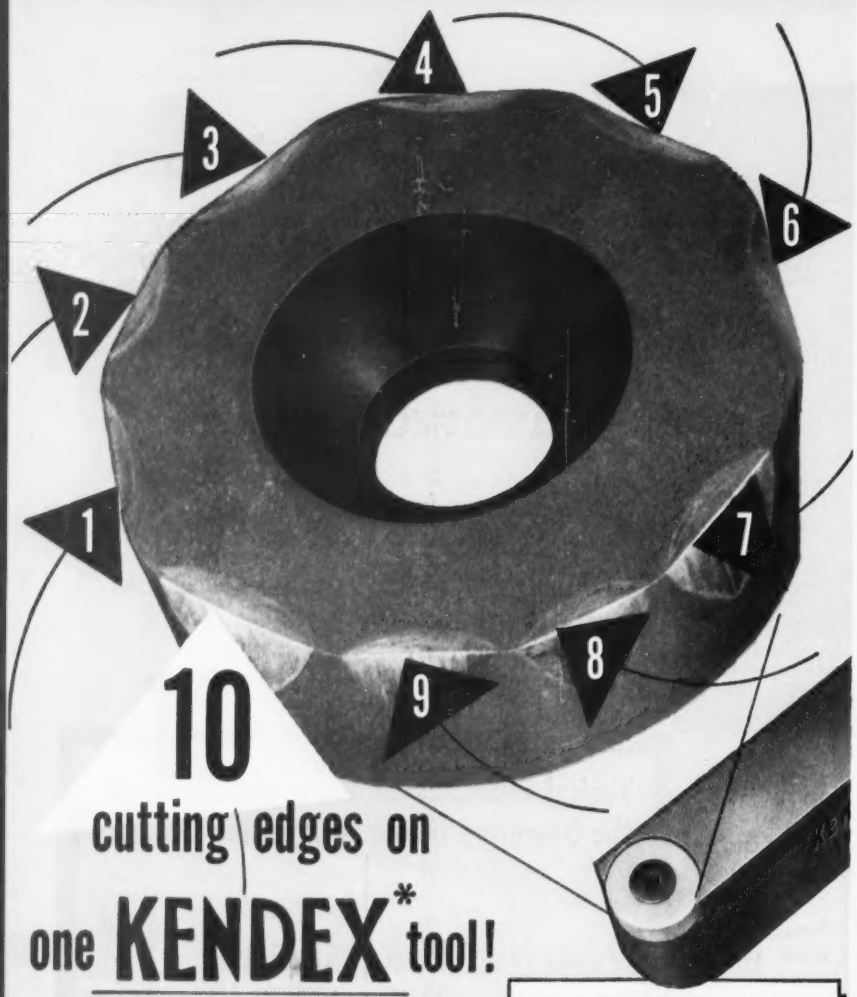
Grinding wheel adapter. Grinding the tapered hole. Held in a precision 4-jaw chuck.



External cylindrical grinding.

GEARGRIND Detroit

THE GEAR GRINDING MACHINE CO.
3921 Christopher
Detroit 11, Michigan



10 cutting edges on one KENDEX* tool!

No tool grinding expense and *minimum* machine down time for tool changing—these are the advantages you obtain from multiple-edge Kendex "throw-away" insert tools. For example:

A Kendex round insert, used to bore 2½" cast iron stators, machined 300 pieces before one cutting edge dulled. Then, without removing the shank from the boring bar, the "button" was revolved to a new cutting position, until 3,000 stators were machined with the insert's 10 cutting edges. Best previous performance, by a conventional brazed tool, was 400 stators per tool grind.

Kendex precision-ground buttons have Kennametal's high wear-resistance, for long life. Screw-mounted, they can be rotated in seconds to new cutting positions without removing or resetting the tool holder . . . a great time-saving feature. When all cutting edges are used, the insert is thrown away—replacement cost is slight compared to that of regrinding.

Only Kennametal makes Kendex "throw-away" inserts. Ask your nearest Kennametal tool representative to help you apply this cost-saving tooling to suitable operations in your plant. Kennametal Inc., Latrobe, Pa.

*Registered Trade-Marks

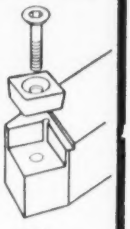
How KENDEX* Works

1

Hard, strong, wear-resistant Kennametal is molded into square, round, or triangular Kendex inserts, which are precision ground.

2

Kendex inserts are mounted to suitable tool holders with socket head screws.



3

When edge becomes dull, insert is turned to new cutting position. When all cutting edges have been used, insert is thrown away; no regrinding.

KENNAMETAL*

CEMENTED CARBIDE TOOLING THAT INCREASES PRODUCTIVITY

SALES OFFICES IN PRINCIPAL CITIES

A-8

BURS
See Files and Burs, Rotary

BUSHINGS, Brass, Bronze, Carbide, Etc.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Johnson Bronze Co., New Castle, Pa.
Kennametal, Inc., Latrobe, Pa.

BUSHINGS, Hardened
Colonial Bushings, Inc., 31780 Groesbeck Hwy., Fraser, Mich.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
U. S. Steel Co., Inc., 436 7th Ave., Pittsburgh, Pa.
U. S. Tool Co., Inc., 255 N. 18th St., Ampere, N. J.

BUSHINGS, Jig
Colonial Bushings, Inc., 31780 Groesbeck Hwy., Fraser, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Universal Engrg. Co., Frankenmuth, Mich.

CABINETS, Tool
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

CALIPERS
Alina Corp., 401 Broadway, New York 13, N. Y.
Ames, B. C., & Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

CAM CUTTING MACHINES
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Sunstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

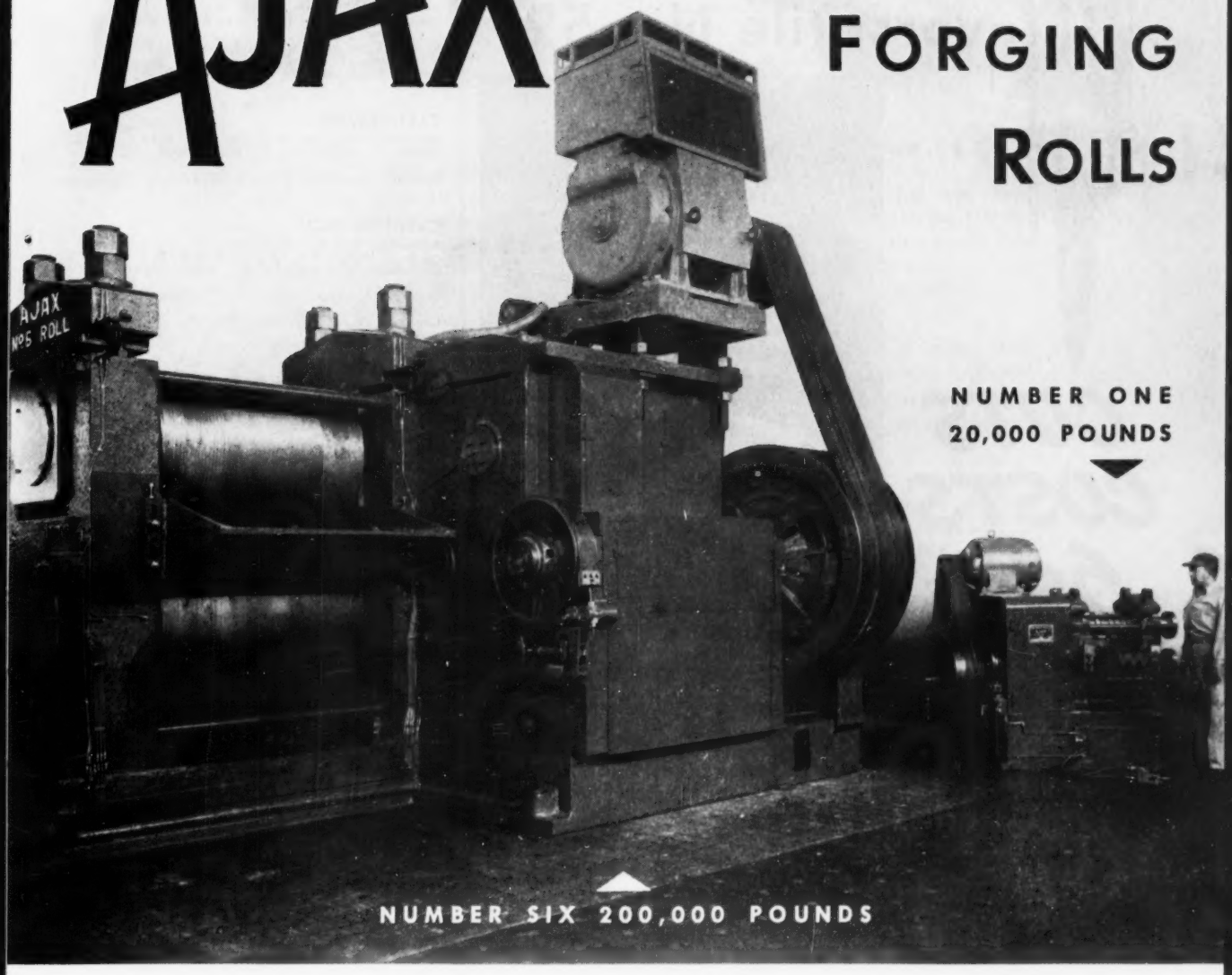
CAM MILLING AND GRINDING MACHINES
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Landis Tool Co., Waynesboro, Pa.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Rowbottom Machine Co., Waterbury, Conn.

CAMS
Eisler Engrg. Co., Inc., 760 S. 13th, Newark 3, N. J.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Rowbottom Machine Co., Waterbury, Conn.

CARBIDES, TANTALUM, TITANIUM AND TUNGSTEN
Alleghany Ludlum Steel Corp., Pittsburgh, Pa.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Wesson Metal Corp., Lexington, Ky.
Willey's Carbide Tool Corp., 1340 W. Vernor Hwy., Detroit 1, Mich.

(*Continued on page 322*)

AJAX COMBINATION DIE FORGING ROLLS



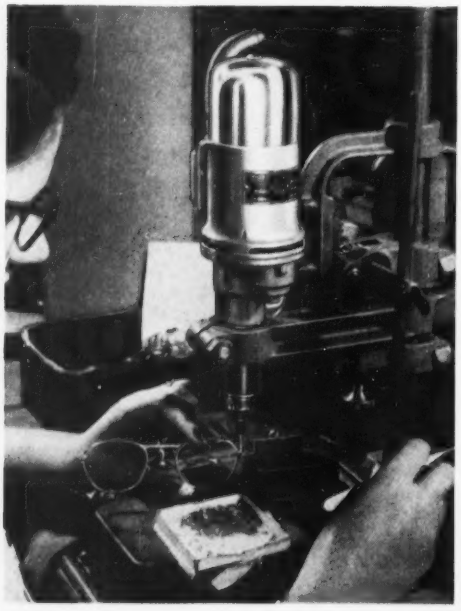
NUMBER SIX specifically used for forging aircraft components. 200,000 pound AJAX FORGING ROLL shown at the left and foreground above is designed for pre-rolling blanks for subsequent DROP forgings.

NUMBER ONE universally used in aircraft, automotive, agricultural industries. 20,000 pound AJAX FORGING ROLL shown at the right above is designed for rolling reduced tapered and straight forgings and pre-rolling blanks for subsequent PRESS forgings.

BUILT IN SIX SIZES FROM NUMBER 0 TO NUMBER 6.
ILLUSTRATED AND DESCRIBED IN BULLETIN 91A.

THE AJAX MANUFACTURING COMPANY
EUCLID BRANCH P. O. CLEVELAND 17, OHIO
110 S. DEARBORN ST. CHICAGO 3, ILLINOIS
DEWART BUILDING NEW LONDON, CONN.

Millers Falls versatile No. 52



CUTS COSTS 64%

on a job that "couldn't be done" with a power screw driver

Driving tiny optical screws (.045" diam., 90 threads per inch) in delicate eye glasses – for years this operation has been considered impossible for a power driver.

Yet today a Millers Falls No. 52 is doing the job – quickly, accurately, safely – and saving 64% in labor costs for a leading optical manufacturer.

The secrets: 1) Millers Falls patented, super-sensitive "Adjustomatic"® Clutch, which is capable of controlling torque to inch-ounces. 2) Ingenious special fixtures developed as a result of Millers Falls wide experience in solving similar problems.

Delicate or High Torque Driving —No Job Too Tough for Millers Falls Electric Screw Drivers

Again and again, manufacturers have found the answer to faster, more economical assembly in Millers Falls Electric Screw Drivers. Whether your requirements call for delicate, feather-light torque control or powerful, heavy-duty driving, Millers Falls has the drivers and the know-how to save you time and money on practically any screw driving application.

Write for complete details on Millers Falls wide line of high-speed electric screw drivers. Capacities for machine screws up to 3/8", for wood screws up to #20 – 2½". Full information on request – or better yet, let us arrange for a convincing demonstration on your own work.

MILLERS FALLS TOOLS SINCE 1868

The Mark of Superiority

MILLERS FALLS COMPANY
GREENFIELD, MASS.

CASEHARDENING FURNACES
See Furnaces, Heat-Treating

CASTINGS, Aluminum, Brass, Bronze, Magnesium, Etc.
Bethlehem Steel Co. (Brass and Bronze only), Bethlehem, Pa.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Mueller Brass Co., Port Huron 35, Mich.

CASTINGS, Die
American Brass Co., Waterbury 20, Conn.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Madison-Kipp Corp., Madison, Wisc.

CASTINGS, IRON
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engineering Co., Chambersburg, Pa.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Link-Belt Co., 180 W. Duncannon Ave., Philadelphia 20, Pa.

CASTINGS, Steel, Alloys, Etc.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Lebanon Steel Foundry, Dept. J, Lebanon, Pa.
Link-Belt Co., 180 W. Duncannon Ave., Philadelphia 20, Pa.
U. S. Steel Corp., Columbia Steel Co., Div., 436 7th Ave., Pittsburgh, Pa.

CEMENT, Disc Grinding Wheel
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

CENTERING MACHINES
Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Machine Works, Front St., and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Synder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sunstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

CENTERS, Lathe
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd. Plymouth, Mich.

CHAINS, Power Transmission and Conveyor
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.

(*Continued on page* 324)

For more information on products advertised, use Inquiry Card, page 265

Now . . .

You can produce MORE for LESS with

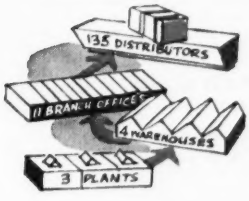
"ONE STOP" TOOLING SERVICE

Profit, today, must come from production . . . with overhead, sales, labor, and material costs at constant or increasing high levels. The need to produce more product for the same money or the same volume of product for less money makes *tooling* the *key* to profit!

Only Firth Sterling can serve you so completely in solving the tooling problems that enable you to make production profits . . . for these six convincing reasons:

UNBIASED RECOMMENDATIONS Because Firth Sterling makes *both* steel and carbide tooling materials, you get completely unbiased recommendations. The exactly right tools or tooling materials will be matched to your production needs, resulting in better, faster, cheaper production.

UNLIMITED SELECTION *Only* Firth Sterling offers so many grades, styles and sizes of both steels and carbides from *one* source of supply . . . 16 High Speed Steels, 53 Tool and Die Steels, 6 High Temperature Alloys, 12 Tungsten Carbides embracing standard tools and tips, toolholders and inserts, dies, perforators, and "specials" *plus* Chromium Carbides, Stainless Specialties, Titanium Carbide Cermets, Firth Heavy Metal, and Zirconium!



EFFECTIVE NATIONAL DISTRIBUTION Three plants, 4 warehouses, 11 branch offices and 135 distributors strategically located in the manufacturing centers of the country assure readily accessible supply sources for all your tooling needs.

CONSTANT RESEARCH Continuing full-scale research with emphasis on product improvement, specialty steels, carbides, new metals and new methods assures you years-ahead tooling procedures when you make Firth Sterling your one-stop source of supply.

PACKAGED TOOL LINE The most complete line of packaged tools available comes in standard quantities, easy to handle, stock, identify and inventory . . . in both steel and carbide.

ONE SOURCE MAKES SENSE Yes, only Firth Sterling can so adequately provide one-stop, one-source-of-supply tooling service with its assurance of unbiased recommendations, simplified lower-cost ordering . . . resulting in better, faster, cheaper production. It makes sense, doesn't it? Ask Firth Sterling to analyze your tooling problems . . . to produce *more* for *less.*

R-297

Firth Sterling

—INC—

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PRODUCTS OF FIRTH STERLING METALLURGY

High Speed Steels
Tool and Die Steels
Stainless Specialties
High Temperature Alloys
Zirconium
Sintered Tungsten Carbides
Firth Heavy Metal
Chromium Carbides
High Temperature Cermets

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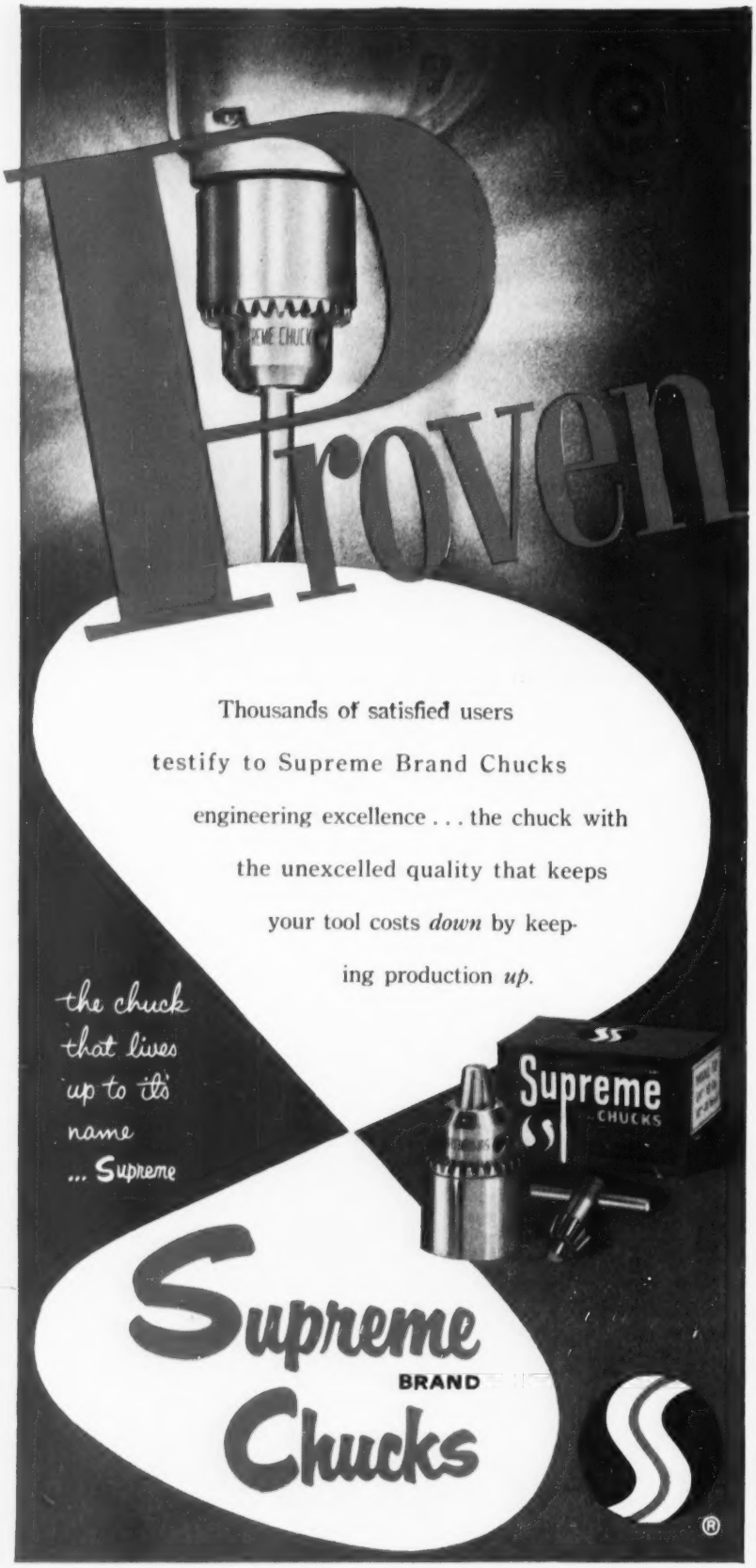

SUPREME PRODUCTS, INC., 2222 So. Calumet Ave., Chicago 16, Ill.

CHISELS AND CHISEL BLANKS

Bethlehem Steel Co., Bethlehem, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.

CHUCKING MACHINES

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Goss & DeLeeuw Mch. Co. (Multiple Spindle), Kensington, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
National Acme Co., (Single and Multiple Spindle) 170 E. 131st St., Cleveland, Ohio.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Sunstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKS, Air Operated

Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hufford Machine Works Inc., 1700 E. Grand Ave., El Segundo, Cal.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
Schrader' Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Tomkins-Johnson Co., Jackson, Mich.
Whiton Machine Co., 190 Howard St., New London, Conn.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

CHUCKS, Collet or Split

See Collets

CHUCKS, Diaphragm

DoAll Co., 254 N. Laural Ave., Des Plaines, Ill.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Van Norman Co., 2640 Main St., Springfield 7, Mass.
Woodworth, N. A. Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

CHUCKS, Drill

Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Supreme Products, Inc., 2222 So. Calumet, Chicago 16, Ill.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

CHUCKS, Full Floating

Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Gisholt Mch. Co., Madison 10, Wis.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

(*Continued on page* 326)

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for high speed nonferrous metal milling

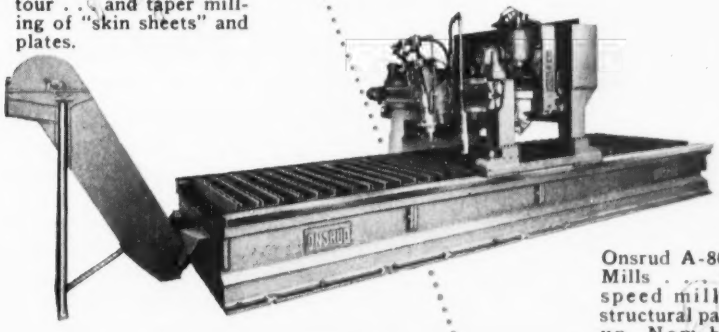
Onsrud

HI-FEED HI-SPEED MACHINES

the mighty work horses of the aircraft industry

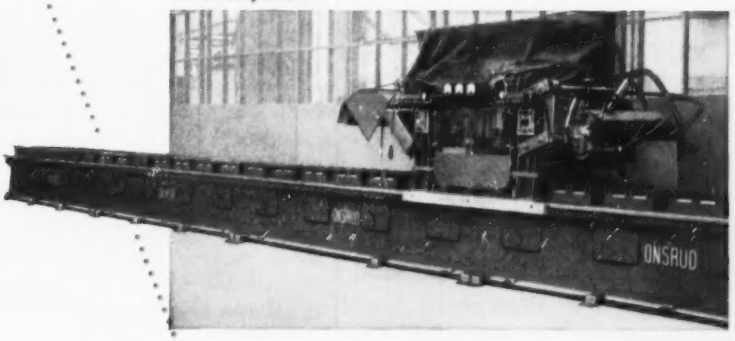
Not "imagineering" hopes of the future, but actual heavy duty, super-high-speed milling machines . . . performing the tough, rough jobs that demand endurance and stamina twenty-four hours a day. Such are the Onsrud machines that are helping to build the jets and prototypes of America's aircraft industry. Designed for the milling of aluminum and related metals, these Onsrud machines mill everything from small precision parts to the huge structural plate members of wings and fuselage . . . removing colossal quantities of metal at fantastic production speeds. Onsrud machine design principles, now proved by almost twenty years of application are the key to the fastest production in nonferrous milling . . . for the aircraft industry, and all other fields of nonferrous metalworking. Typical Onsrud machines are shown here.

Onsrud A-72 InvOmil . . . the most unusual machine in metalworking! Reduces from hours to minutes, profile milling jobs with irregular contour . . . and taper milling of "skin sheets" and plates.



Onsrud Radial Arm Milling Machine (or router) . . . for high speed cut-out milling of flat sheet parts.

Onsrud A-80 Series Spar Mills . . . for the high speed milling of long structural parts in one set-up. Now built in bed lengths up to 90 feet. Larger sizes can be built when required.



Onsrud A-24 Milling Machines . . . for general milling of all types of parts. Horizontal head permits "rise and fall" milling under profile bar control.

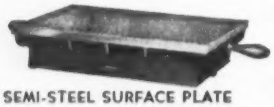
For faster, lower cost production milling . . . in aircraft and all other industries . . . let Onsrud engineers give you complete information.

ONSRUD MACHINE WORKS INC.

3940 PALMER STREET • CHICAGO 47, ILLINOIS

LAYOUT SURFACE PLATE

Precision-built for tool and machine industries, Challenge Equipment comprises a selection of time-saving devices for layout, inspection, checking, lapping, welding and assembly operations. Included in this line are Layout Surface Plates . . . Clamp Edge Layout Plates . . . Reading Tables . . . Checking Tables . . . Lapping Plates . . . Welding Tables . . . Surface Plates . . . Surface Plate Equipment . . . Bench Plates and Blocks. Check the coupon below for complete information on any or all products. 719



SEMI-STEEL SURFACE PLATE

Challenge

TRADE-MARK ®

THE CHALLENGE MACHINERY CO.
Office, Factories and Show Room:
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☐ Surface Plate Equip. ☐ Utility Bench
☐ Complete Catalog ☐ Welding Tables

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City _____ State _____

CHUCKS, Gear

Gleason Works, 1000 University Ave., Rochester, N. Y.
Horton Chuck, Windsor Locks, Conn.
Supreme Products, Inc., 2222 So. Calumet, Chicago 16, Ill.
Woodworth, N. A. Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

CHUCKS, Lathes, etc.

Buck Tool Co., 220 Schippers La., Kalamazoo, Mich.
Bullard Co. Brewster St., Bridgeport 2, Conn.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck, Windsor Locks, Conn.
Jacobs Mfg. Co., West Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Whiton Machine Co., 190 Howard St., New London, Conn.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

CHUCKS, Magnetic

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Hanchett Magna-Lock Corp., Big Rapids, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Co., Inc., Worcester, Mass.

CHUCKS, Power Operated

Skinner Chuck Co., 344 Church St., New Britain, Conn.

CHUCKS, Quick Change and Safety

Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Jarvis, Charles L., Co., Middletown, Conn.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Ring Wheel

Gardener Mch. Co., Div. Landis Tool Co., 414 E. Gardner St., Beloit, Wis.

CHUCKS, Tapping

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.

CIRCUIT-BREAKERS

General Electric Co., Schenectady 5, N. Y.

CLAMPING APPLIANCES FOR MACHINE TOOLS

Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.

CLAMPS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Mead Specialties Co., 4114 N. Knox Ave., Chicago 41, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Starrett, The L. S., Co., Athol, Mass.
Williams, J. H. & Co., 400 Vulcan St. Buffalo 7, N. Y.

CLEANERS, Chemical, for Metal

Bullard Co., Bullard-Dunn Process Div., Brewster St., Bridgeport 2, Conn.
Oakite Products, Inc., 19 Rector St., New York N. Y.

CLUTCHES

Clearing Mch. Corp., 6499 W. 65th St., Chicago 38, Ill.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Formsprag Co., 23609 Hoover Rd., Van Dyke, Mich.
Link-Belt Co., 300 West Pershing Rd., Chicago 9, Ill.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Rockford Clutch Div., Borg-Warner Corp., 410 Catherine St., Rockford, Ill.
Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.

COLLARS, Safety

Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Standard Pressed Steel Co., Jenkintown, Pa.

COLLETS

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engrg. Co., Frankenmuth 2, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

COMPARATORS

See Gages, Comparator.

COMPARATORS, Optical

DoAll Co., 254 Laural Ave., Des Plaines, Ill.
Eastman Kodak Co., Rochester, N. Y.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

COMPOUNDS, Cleaning

Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York.

COMPOUNDS, Cutting, Grinding, Metal Drawing, Etc.

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Broaching & Lopping).
Oakite Products, Inc., 19 Rector St., New York, N. Y.
Shear-Speed Chem. Prod. Div., Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.
Sinclair Refining Co., 600 Fifth Ave., New York.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

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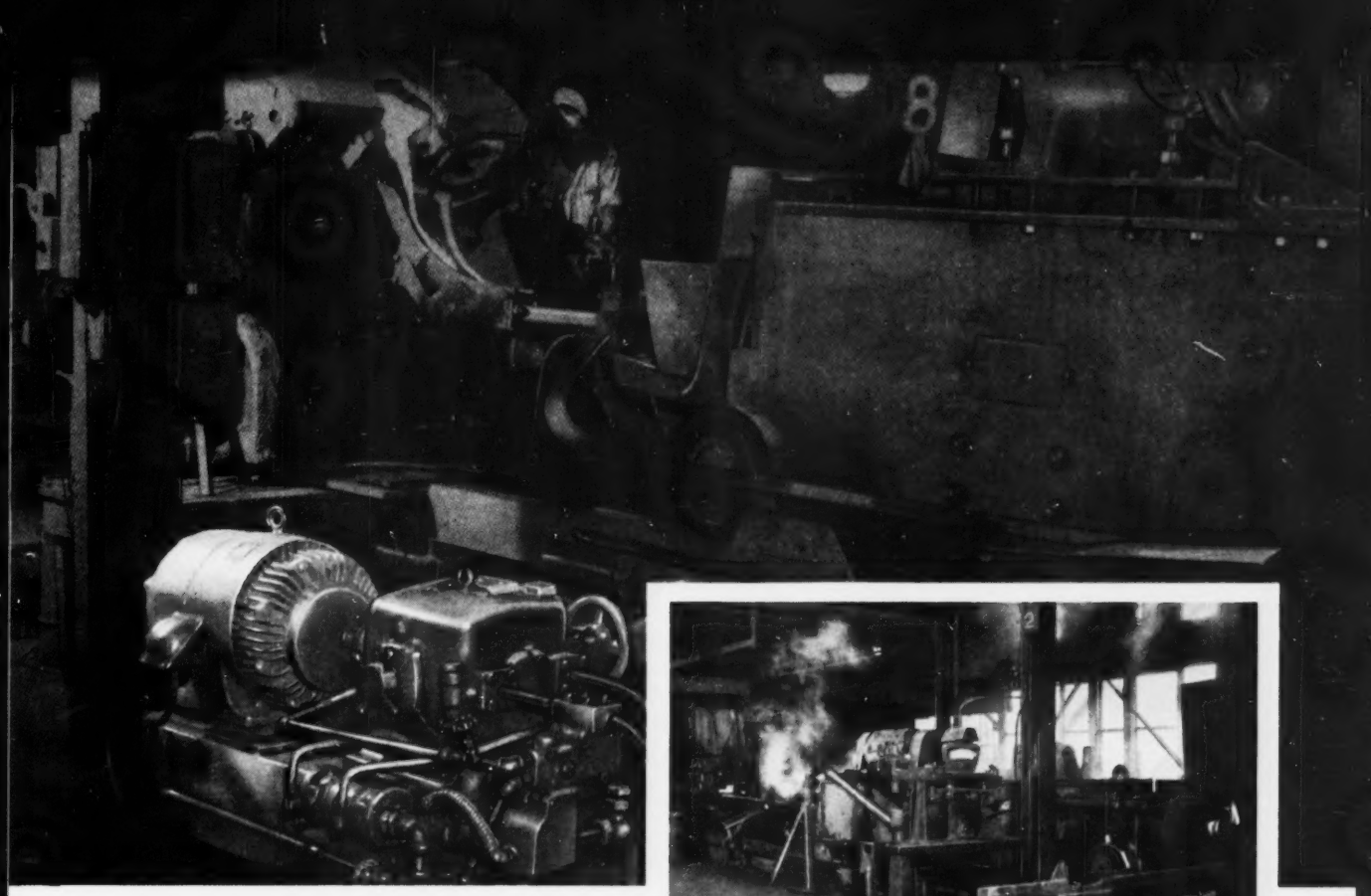
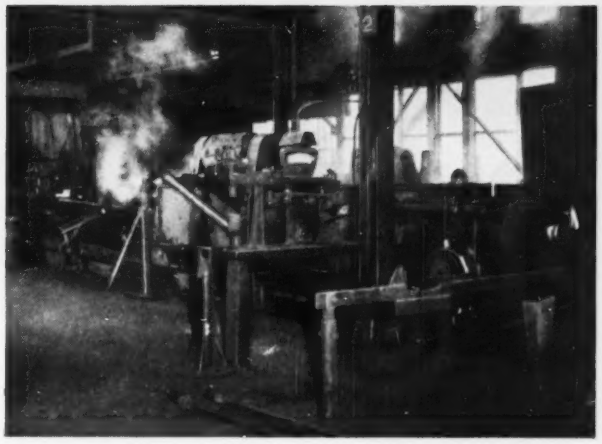




OILGEAR DRIVES ON GLAMORGAN CENTRIFUGAL PIPE CASTING MACHINE

Something more than 5 years ago, the Glamorgan Pipe & Foundry Company, of Lynchburg, Va., a leading manufacturer of cast iron pipe, designed its own centrifugal pipe casting machine, using Oilgear Fluid Power equipment to tilt the ladle and move the casting carriage.

The degree of control over pouring rate and carriage travel afforded by Oilgear has had almost unbelievable results. Scrap caused by irregularities in moving parts has become negligible. Weight controls are well within the close limits set by Industry specifications. Only 3 men are needed to operate the equipment. Despite the fact the machine has averaged 500 operations per day since 1948, maintenance on Oilgear equipment has totaled less than $200.00. The fumes and dirt necessarily present in foundry operations have had no effect on Oilgear fluid power equipment.

TYPICAL OF OILGEAR'S ABILITY TO SOLVE MACHINE DESIGN PROBLEMS

Sure it takes power to tilt a ladle and move a pipe casting machine carriage. But above all, it takes absolute and precise control of the speed of pouring and the speed of carriage travel if the product is to be perfect and uniform.

It not only takes power but power under control to print in register on flimsy cellophane at high speed, to set up paper piles for repetitive serial cuts to hairline register automatically, to cut fish on a continuous conveyor to accurate weight for canning, to vary the speed of a large beater automatically to conform sensitively to the changing viscosity of the mass.

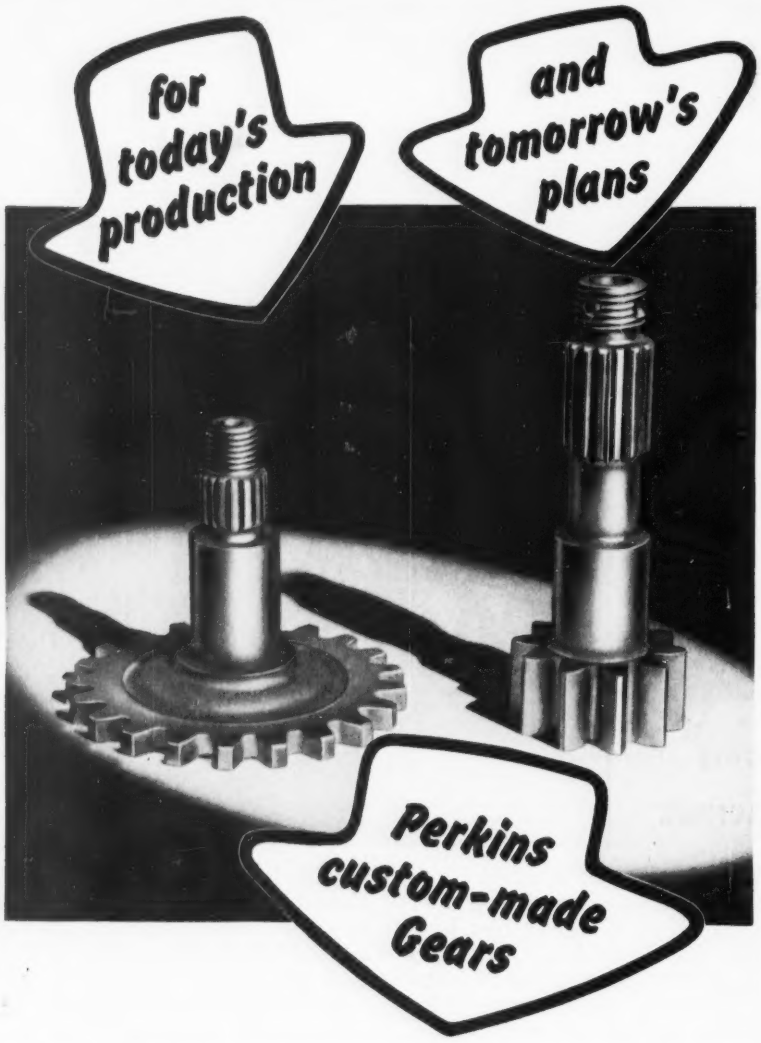
These are all triumphs of Oilgear Fluid Power—where this flexible, controllable, versatile power leads the way to better machine design or to the solution of hitherto unsolved problems.

Think of Oilgear Fluid Power as identical with electrical power . . . generated by a pump . . . applied over conductors through a motor or motor element. But Oilgear Fluid Power can be converted into linear movement as well as rotary; can be exerted statically, without motion; can be varied infinitely, steplessly without additional equipment.

And the unique Oilgear design is oil hydraulic design at its simplest and best. It is generally accepted as the leader in its field. It will cost you nothing to see what Oilgear can do to improve the salability of your equipment . . . may profit you and your users in an amazing degree. THE OILGEAR COMPANY, 1569 W. Pierce St., Milwaukee 4, Wisconsin.

OILGEAR

OILGEAR



GEAR DESIGN and manufacture in general, are ancient arts, but for the requirements of modern machines the scope of analysis, detail design, and test techniques have had to be extended far beyond the considerations acceptable only a relatively short time ago. For example, results obtained by the aircraft industry have revealed greater possibilities for the application of high power gearing.

The high speeds involved in these types of gear drives, however, create particularly strict requirements for accuracy and uniformity of the gears. And this is the very reason why before, during and since the war, the production of aircraft gears has been our number one job! But regardless of application — from aircraft to washing machines — if your product calls for trouble-free power transmission, it calls for PERKINS custom-made GEARS.

NOTE: The PERKINS PRECISION SPRING COILER is the latest development in the spring coiler field and eliminates entirely the use of arbors and long set-up time. It is a complete self-sufficient machine and enables you to make the spring you want when you want it —in seconds. The coiler produces any type of spring, in any diameter and any pitch with this range: Wire sizes .005 to .125. Diameter, from 3/32" to 12" and larger. Size of the compact coiler is only 7 1/2x16". A POWER MODEL is available. Information on request.

PERKINS MACHINE & GEAR CO.

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COMPOUNDS, Resin and Moulding
General Electric Co., Schenectady 5, N. Y.

COMPRESSORS, Air
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

CONTOUR FOLLOWER
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Turchan Follower Machine Co., 8259 Livernois and Alaska Aves., Detroit, Mich.

CONTRACT WORK
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Eisler Engrg. Co., 760 S. 13th, Newark 3, N. J.
Fellows Gear Shaper Co., Springfield, Vt.
Gorham Tool Co., 14400 Woodrow Wilson Detroit, Mich.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland, Ohio.
Minster Machine Co., Minster, Ohio.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Mch. Tool Co., 250 Kishwaukee St., Rockford, Ill.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Wicaco Machine Corp., Stenton Ave. and Louden St., Philadelphia, Pa.

CONTROLS for Electrical, Hydraulic and Pneumatic Units
Saginaw Steering Gear Div. General Motors Corp., Saginaw, Mich.

CONTROLLERS
Allen-Bradley Co., 1326 S. 2nd St., Milwaukee.
Clark Controller Co., Cleveland, Ohio.
General Electric Co., Schenectady 5, N. Y.

CONTROLS, Thermo
Control Products, Inc., 306 Sussex St., Harrison, N. J.

CONVEYORS FOR DUST, CHIPS, ETC.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9.

COOLANT SEPARATORS
See Separators, Oil or Coolant.

COUNTERBORES
Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Besly-Welles Corp., Beloit, Wis.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wison, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Starrett, The L. S., Co., Athol, Mass.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

(*Continued on page* 334)

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Does Your Present Handbook Provide You With This Vital Gear Information?

- Formulas and Tables for Fine-pitch Gears
- Formulas and Tables for Addendums, Dedendums, and Other Dimensions of Hobbed, Shaped and Pre-shaved Gears
- Measurement and Control of Backlash in Gears
- Recommended Backlash for All Types of Gears
- Revised Gleason Systems of Straight and Spiral Bevel Gears
- Formulas, Charts and Step-by-Step Procedure for Designing Bevel Gears
- American Standard Fine-pitch Worms and Worm Gears
- Profile and Pressure Angle Corrections for Cutters and Grinding Wheels Used to Produce Fine-pitch Worms.

This is only part of the *new* information in the big 219-page section covering spur gears, bevel gears, worm gears, helical and herringbone gears. Throughout this section are charts, tables, formulas and worked-out examples for which MACHINERY'S HANDBOOK has long been famous.

Important highlights of some of the new and revised subjects in the 15th Edition.

American Standard Fine-pitch Gears

Tooth form; tooth parts (20 to 200 D.P.); formulas for dedendums and root diameters of fine-pitch gears that are hobbed, shaped or pre-shaved; dimensions required when using enlarged fine-pitch pinions for standard center-distance system or enlarged center-distance systems; classification according to quality; and tolerances for 20-degree involute fine-pitch gear blanks.

Backlash in Gears

Recommended backlash with tables for American Standard spur, helical, herring-bone and bevel gears, American Standard 20-degree involute fine-pitch gears, Gleason system straight, zerol and spiral beval gears, and Gleason hypoid gears.

Dedendums and Root Diameters for Hobbing, Shaping and Pre-Shaving Spur Gears

Formulas and tabulated data for a wide range of pitches covering recommended dedendums and root diameters of hobbed, shaped and pre-shaved $14\frac{1}{2}$- and 20-degree involute full depth, 20-degree involute fine pitch, and 20-degree involute stub teeth.

Gleason System Bevel Gears

Formulas, tabulated data, and design charts for Gleason straight and spiral bevel gears for all types of industrial applications. Design of bevel gear blanks, mountings for bevel gears, thrust and radial loads produced by bevel gears. Durability and strength of bevel gears. Worked out examples of bevel gear design.

American Standard Fine-pitch Bevel Gears

Formulas and tabulated data for dimensions of fine-pitch straight and angular straight bevel gears.

American Standard Milling Cutters

Definitions of milling cutter terms; number of teeth for optimum performance; dimensions and tolerances of standard types of milling cutters; and set-ups for grinding clearance angles on milling cutter teeth.

American Standard Single-point Tools and Tool Posts

Standard dimensions of tool shanks, tool-post openings, and lathe center heights; types of standard tool posts; lengths of solid square and rectangular tools; sizes of tool shanks; and sizes, dimensions, and commercial catalog numbers of sintered-carbide tips for single-point tools.

Honing

Amount and rate of stock removal, formula for rotative speeds, recommended tolerances, and possible adjustments for eliminating undesirable conditions.

Power Brush Finishing

Characteristics and applications of brushing wheels, brushing speeds, and adjustments for eliminating undesirable conditions.

Materials

Nickel and nickel alloys, titanium and titanium alloys, copper-silicon and beryllium copper alloys, and revised list of chemical elements, atomic weights and melting points.

Tool and Die Steels

Compositions and properties affecting selection of water hardening, oil hardening, air hardening, shock resistant, hot work, and high speed tool and die steels.

American Standard Involute Splines

Formulas and tables for classes of fit, allowable error, space width and tooth thickness dimensions, and pin measurements.

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NEW INFORMATION ON THESE SUBJECTS

American Standard Reamers

Dimensions and tolerances for hand reamers, rose chucking and fluted chucking reamers, expansion reamers, shell reamers, center reamers and machine countersinks, arbors for shell reamers, and driving slots and lugs.

Standard Washers

Nominal and limiting dimensions of plain washers, spring lock-washers, and internal-tooth, external-tooth, and countersunk external tooth lock washers.

Standard Straight Pipe Threads

Sizes, threads per inch and limiting dimensions of straight pipe threads for free-fitting mechanical joints for lock-nut connections; Dryseal internal threads (used without sealer); and internal threads in pipe couplings (used with sealer).

Standard Dryseal Taper Pipe Threads

Dimensions for crest and root modification of standard taper pipe threads for provision of metal-to-metal self-sealing joint.

American Standard Screw-Thread Gages

Thread form, tolerances and wear allowances for the GO, HI and LO thread gages, also formulas for limiting dimensions of thread gages and setting plugs for use with Unified and American Standard screw threads.

American Standard Square and Hexagon Bolts and Nuts

Important changes in dimensions of bolts and nuts summarized with table showing comparison of old and new across-flats dimensions; also numerous tables showing sizes and limiting dimensions of standard types.

American Standard General-purpose Acme Screw Threads

Classes, thread form, allowances, tolerances, limiting dimensions, and preferred thread series, of the newly adopted General-purpose Acme Screw Threads.

American Standard Stub Acme Screw Threads

Thread form, allowances, tolerances, limiting dimensions and preferred thread series of the revised Stub Acme threads.

Feeds and Speeds for Gear Hobbing

Climb hobbing; use of single- and multiple-thread hobs; and feeds and speeds for roughing with single- or multiple-thread hobs and finish hobbing of various types of gears.

Standard Ball, Roller, and Needle Bearings

Description, designations, ranges of standard sizes, boundary dimensions and tolerances for standard types of ball, roller, and needle bearings.

A modern handbook is a necessity for every man now holding or aiming for a responsible job in the mechanical industries.

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The 12th Edition of MACHINERY'S HANDBOOK was published in 1943—only 11 years ago—but . . . 474 pages were revised and 96 pages were added to provide new material for the 13th Edition in 1946. Then . . . 290 pages were revised to provide new material for the 14th Edition in 1949. And now . . . 432 pages have been revised to make the New 15th Edition better than ever and ready to help you tackle the problems of today.

—HOW FAR BACK ARE YOU IN THE HANDBOOK PARADE?

See Complete Contents On Back Page

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Below is a list of 145 main subjects in MACHINERY'S HANDBOOK. These main subjects include thousands of items which may be located readily by the very complete index. In addition, a special thumb index provides for opening the book instantly to any of fourteen main divisions most frequently consulted.

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The Slide Rule
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Areas and Volumes
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Knurls
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Files and their Application
Hacksaw Blades

Metals and their Heat Treatment
Steels for Small Tools
Stock for Screw Machine Products
Iron and Steel Manufacture
SAE and AISI Carbon and Alloy Steel Numbers and Compositions
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Testing the Hardness of Metals
Iron and Steel Castings
Heat Treatment Processes for Steel
Sub Zero Treatment of Steel
Heat Treatment of Non-ferrous Alloys
Brass and Bronze Alloys
Cast and Wrought Aluminum Alloys
Cast and Wrought Magnesium Alloys
Nickel and Nickel Alloys
Titanium and Titanium Alloys
Copper-Silicon and Beryllium Copper Alloys

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Cam Milling
Tapping and Thread Cutting
Thread Milling
Thread Grinding
Thread Rolling
Helical Milling
Broaching
Knurling
Screw Machine Feeds and Speeds
Grinding
Honing
Speeds and Feeds for Various Metal Cutting Operations
Tool Grinding
Cutting Fluids
Machining Magnesium and Aluminum
Machining Plastics
Machining Nickel Alloys
Abrasive Cutting
Milling Machine Indexing
Gear Cutting

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Extrusion of Metals
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Precision Investment Casting
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Forge Shop Welding Methods
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Welding with Thermit
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Punches, Dies and Presswork
Drop-forging Dies

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Honing Process
Laps and Lapping
Power Brush Finishing
Polishing and Buffing
Grinding
Chromium Plating
Coloring Metals

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Self-tapping Screws
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Nails and Spikes
Rivets
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Plain and Lock Washers
Pipe Thread System

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Crane Chains, Hooks, Eyebolts, and Slings
Shackles
Lifting Magnets
Wire Rope

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Measuring Screw Theads
Measuring Instruments and Gaging Methods
Weights and Measures
Metric System of Measurement and Conversion Tables
Weights of Various Metal Shapes and Parts

Allowances and Tolerances
Allowances and Tolerances for Plain Fits
Tolerances for Sheets, Plates, Bars and Tubes
Tolerances for Forgings
Allowances and Tolerances for Screw Threads
Tolerances for Thread Gages
Tolerances for Various Machining Operations
Tolerances for Fine-pitch Gear Blanks
Backlash Tolerances for Gears

Electric Motors
Standards
Characteristics
Applications
Maintenance

Other Subjects
Dimensioning and Checking Drawings
Wire and Sheet Metal Gages
Jigs and Fixtures
Bearing Lubricants
Change-Gear Ratios
Standard Taper Pins
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THIS IS DEEP CASE HARDENING AND Here's How It's Controlled

Operator determines dew point of protective atmosphere in hardening furnaces. Microcarb control in background maintains uniform carbon concentration inside carburizing furnaces.

Metallurgist analyzes carbon content extracted from melted shavings of gradient test bar which was run through with batch of deep case hardened gears.

BRAD FOOTE
DEEP CASE HARDENING
INCREASES GEAR LIFE 50%

Maybe case hardening of the gears you use isn't enough. Maybe deep case hardening...with controlled depth of case, controlled carbon content, and distortion controlled to an infinitesimal degree ...is the answer. Service records of users of BRAD FOOTE deep case hardened gears prove that the life of these gears is increased 50% over that of standard case hardened gears.

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ask for a quotation...Send us your specifications, so we can quote you on deep case hardened BRAD FOOTE Gears. Then order a set to put to test on the toughest job you have. Let them prove to you that deep case hardening, BRAD FOOTE's controlled deep case hardening and minimized distortion, increases gear life 50%.

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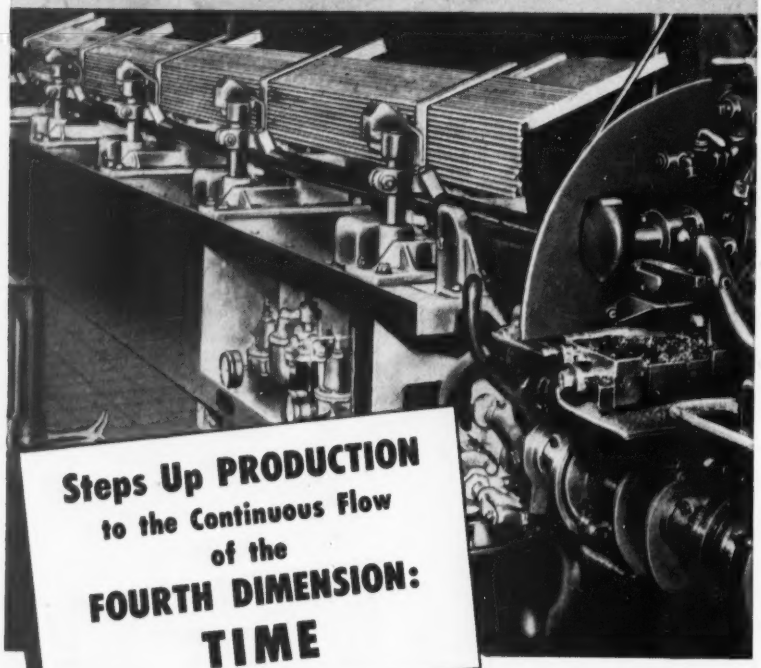
Now... A Screw-Machine-Feed that BREAKS THE TIME BARRIER!



Steps Up PRODUCTION to the Continuous Flow of the FOURTH DIMENSION: TIME

EVERY TIME a screw machine cuts air... every time feed fingers are adjusted or replaced... every time remnant removal forces a shut-down — *that's time lost forever, never again to be made up in the production quota!*

In the modern Lipe Automatic Magazine-Loading Bar Feed, we present a continuous-feed mechanism that utilizes *every minute* of the working day for production...and still more production.

There's *No* cutting air. *No* feed fingers. *No* remnant problem. *No* minimum or maximum run. *No* limit on length of feed. *No* selective stock length requirement.

There IS a definite increase in production — up to 100% on some installations — *at least 30% on every one!*

Send today for FREE BOOKLET giving full details on Lipe's AML Bar Feed — today's big advancement in screw machine stock feeding. We will also supply name of your nearest distributor.

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Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
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Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
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Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.

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Boston Gear Works, 3200 Main St., North Quincy, Mass.
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CRANES, Electric Traveling
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CUTTER GRINDERS
See Grinding Machines, for Sharpening Cutters, Reamers, Hobs, Etc.

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National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Shaving).
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tl. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twist Drill Co., Athol, Mass.
Waltham Mch. Wks., Newton St., Waltham, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

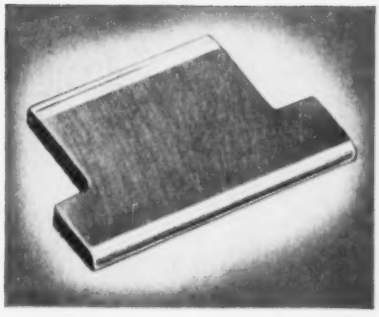
(*Continued on page* 336)

For more information on products advertised, use Inquiry Card, page 265

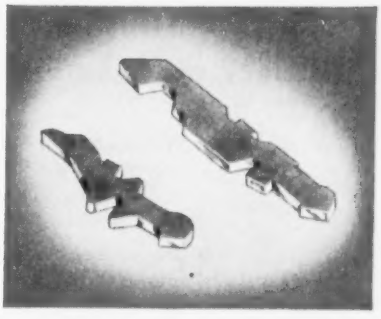
Why wait?
CUT YOUR COSTS NOW!

let the leading manufacturer of broaching equipment show you how to lower your break-even costs.

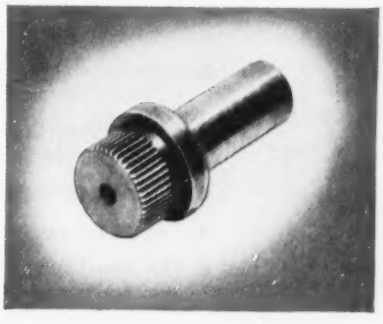
TEN TIMES FASTER than previous methods—broaching top and bottom radii on these automatic transmission reverse band anchors is helping one manufacturer lower the break-even costs. The design called for both edges to be rounded with a taper leading into one of the rounded edges. Besides increasing production by 10 times, the broached surfaces are more accurate, and costs are kept to a minimum. Thousands of these band anchors are being machined between broach sharpenings.



THIRTY TIMES FASTER than milling—broaching lowers costs in the production of the intricate shapes of these copper breaker points. Seven pieces at a time are broached at a rate 30 times faster than by milling. 75,000 pieces are completed before it is necessary to sharpen the broach. 800 to 1000 pieces per hour are broached on one Colonial machine with only two sets of Colonial broaches.



TWENTY TIMES FASTER than other methods—the serrations on the end of this shaft are cut with a button broach in a single pass. Cost per part is reduced substantially because broaching is 20 times faster. This, and hundreds of other applications on file at Colonial, are ample testimony of the tremendous cost-cutting potential that can be yours by utilizing "Unified Broaching" by Colonial. Send us prints of your parts—let us show you how to cut costs over your present machining methods.



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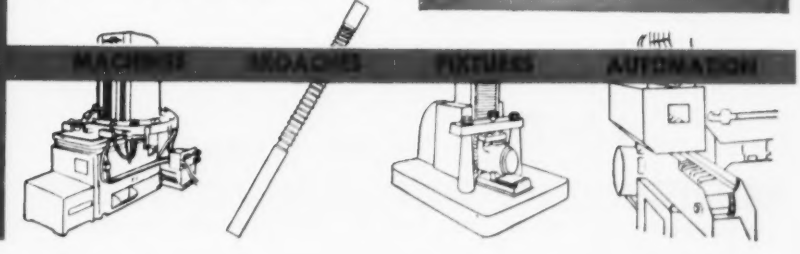

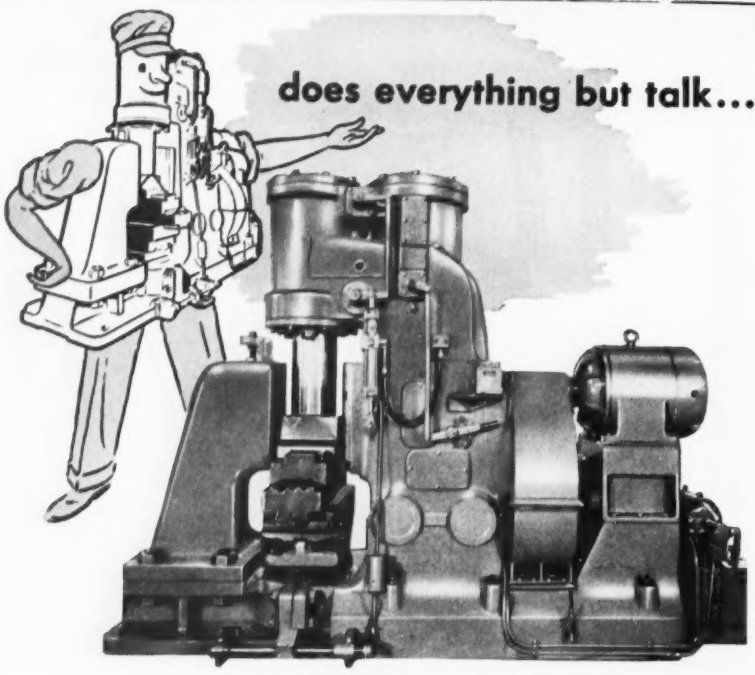

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FORGING HAMMER

just look at these features!

- Outboard Ram Guide, which allows both open and closed die forging and insures positive die mating . . . Anvil is mated to base for exact register.
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Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Keo Cutters, 19326 Woodward, Detroit, Mich.
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DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 1440 Woodrow Wilson, Detroit, Mich.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Hanson-Whitney Co., Div., Whitney Chain Co., Hartford, Conn.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kennametal, Inc., Latrobe, Pa.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tl. Co., Rochester, Mich.
OK Tool Co., Milford, N. H.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Willey's Carbide Tool Co., 1340 W. Verner Hwy., Detroit 1, Mich.

CUTTERS, Rotary

See Files & Burs, Rotary

CUTTING COMPOUNDS

See Compounds, Cutting, Grinding, Etc.

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Cincinnati Milling Products Div., Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cimcool Div., Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Master Chemical Corp., 13 Huron St., Toledo 1, Ohio.
National Refining Co., P.O. Box 6479, Cleveland 1, Ohio.
Shear-Speed Chemical Products, Div. Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.
Sinclair Refining Co., 600 Fifth Ave., New York.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

(*Continued on page* 338)

For more information on products advertised, use Inquiry Card, page 265

Power! Control!! Production!!!

with Schrader Valves

Compressed air, plus automatic control, has given industry a muscle-saving power to produce more economically . . . without fatigue . . . with increased production.

Reliable valves are an absolute necessity. And **Schrader Valves** are the accepted solution, wherever air controls are used. Schrader Valves are designed and built by a company whose success dates back to 1844—more than a century of experience in air control.

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Schrader

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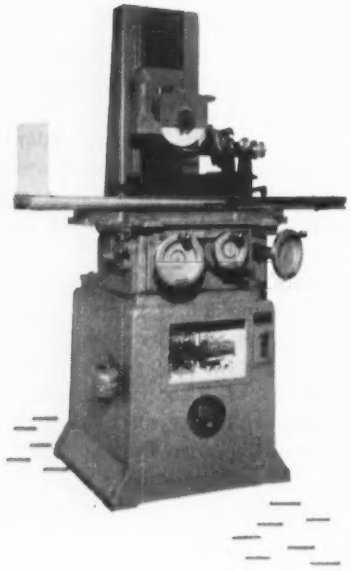
with REID GRINDERS



It's strictly a dollars and sense proposition. The cost of a new surface grinder is not high in relation to the benefits that accrue from more accuracy, better quality finishes and ease of operation.

And it certainly makes sense, in today's competitive business world to replace older type grinders that invite work-spoilage and rejection.

If you're still using over-age surface grinders, it will be good "insurance" to talk with your Reid dealer today.

He'll show you why modern Reid Grinders will increase efficiency in your toolroom.

see our catalog in MACHINE TOOL CATALOGS or write for copy

For the full story on Reid Surface Grinders, please write for Bulletin 618-2

Reid Brothers Company, Inc.

CUTTING-OFF MACHINES
Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Mch. Co., Windsor, Vt. (Lathe Type).
Consolidated Mch. Tool Co., Rochester, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Johnson Mfg. Co., Albion, Mich.
Landis Machine Co., Waynesboro, Pa. (Pipe).
Modern Machine Tool Co., 601 S. Water St., Jackson, Mich. (Lathe Type for Tubing).

CUTTING-OFF MACHINES, Abrasive Wheel
Allison Co., Bridgeport, Conn.
Campbell Mch. Div., American Chain & Cable 929 Conn. Ave., Bridgeport, Conn.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614 G. N. Lexington Ave., Pittsburgh 8, Pa.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.

CUTTING-OFF MACHINES, Cold Saw
See Sewing Machines, Circular

CUTTING-OFF MACHINES, Metal Band Saws
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Grob, Inc., Grafton, Wis.

CUTTING-OFF TOOLS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Luers, J. Milton, 12 Pine St., Mt. Clemens, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

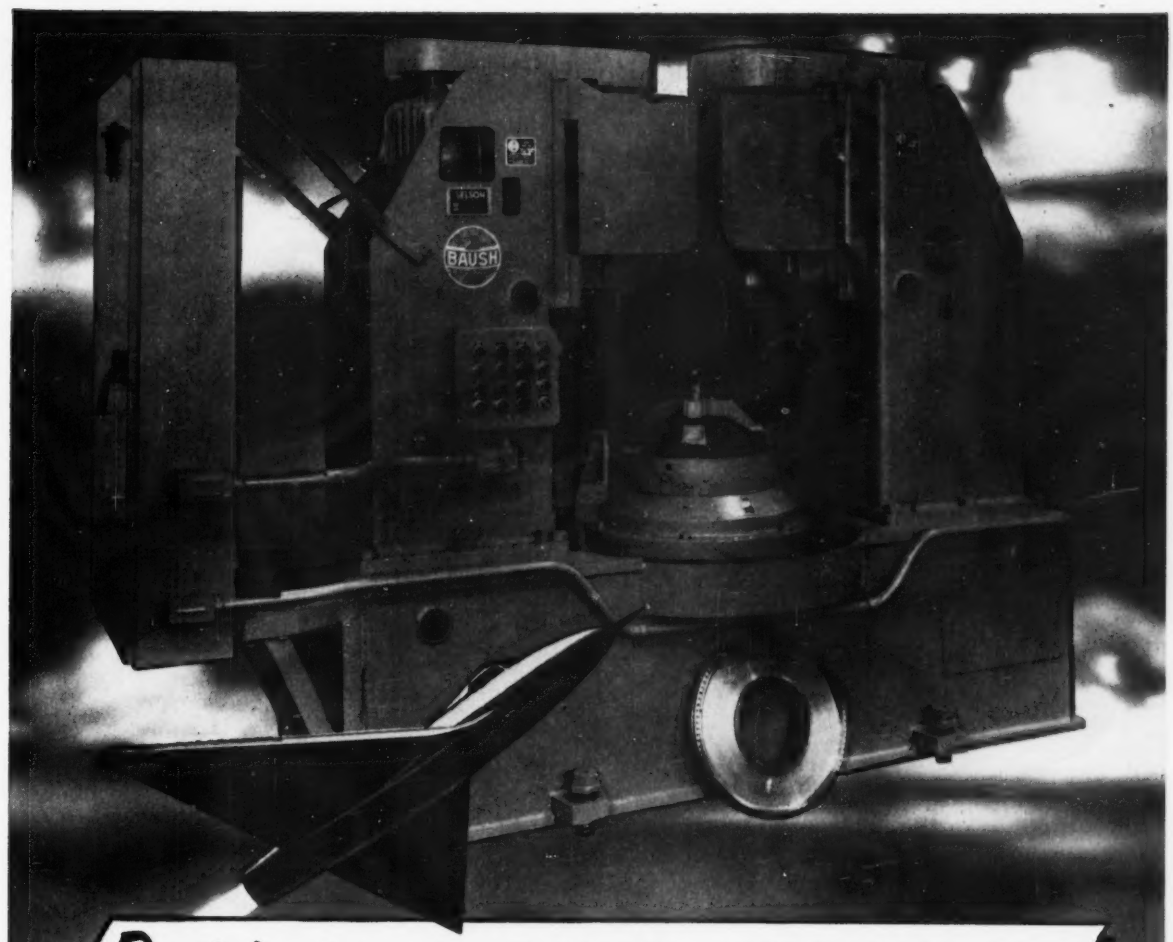
CUTTING-OFF WHEELS, Abrasive
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 37, Pa.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.

CYLINDER BORING MACHINES
Baker Bros., Inc., Sta. F, P. O. Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Moline Tool Co., 102 20th St., Moline, Ill.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

CYLINDERS, Air
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Tomkins-Johnson Co., Jackson, Mich.

(*Continued on page* 342)

For more information on products advertised, use Inquiry Card, page 265



British Jets via BAUSH AUTOMATION

The Baush Vertical Dual Column Quill Feed Cam Unit Machine illustrated was designed and built to do one job, and one job ONLY, on British Jet parts:

To drill and ream a total of 97 holes, .220" diam. on an 18.946" diam. bolt circle through a double flange in stainless steel Compressor Rotor Wheels, without being touched by the operator.

Each of these Baush units is furnished with a single spindle—one unit for drilling and one unit for reaming. Automatic hydraulic indexing fixture with stationary bushings guides drills and reamers.

Once the part is loaded into fixture and machine is started by operator, the cycle is completely automatic until all 97 holes have been drilled and reamed.

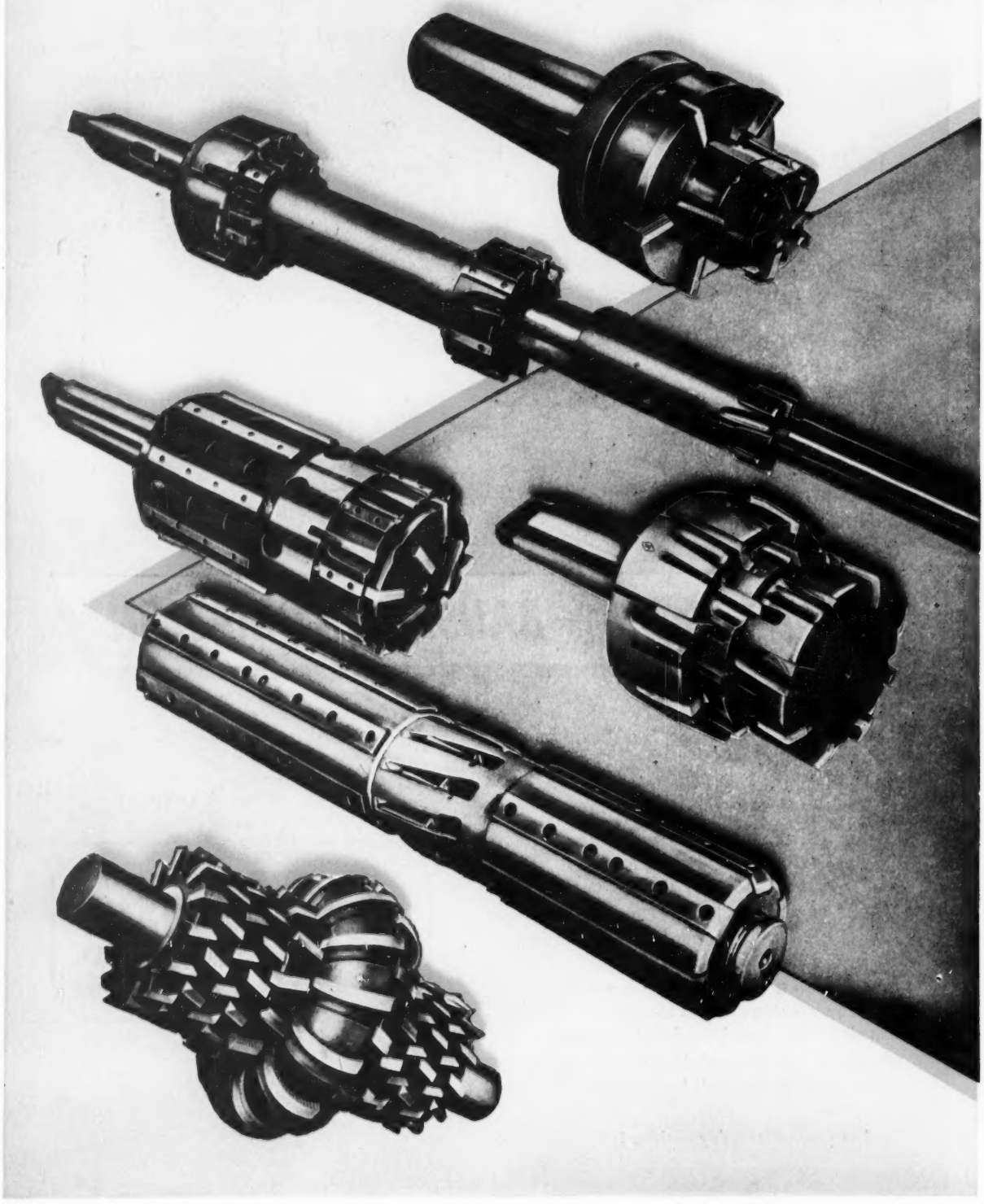
Why not use Baush knowledge and ingenuity of design to build machine tools for your special machine operations.

Send us your prints today — there is no obligation.

BAUSH
MACHINE TOOL CO.
SPRINGFIELD 7, MASSACHUSETTS

Aircraft engine and frame

boost metal-



manufacturers

cutting operations with . . .

one-pass OK multiple diameter tools

Over fifty percent of O K tool orders from the aircraft industry are for combination cutters, designed to perform two, three and four operations with one pass of the tool. These tools take bulldog-bite rough cuts, or cobweb-thin, micro-finish cuts, with no restrictions as to metals, which run from stainless steel for jet-engine parts to heat-treated aluminum for cylinders and high-speed steel for triple-step lathe chuck jaws. Former production records are demolished! Where, yesterday, five pieces on the floor, was considered good; today, you find 50 pieces, inspected and passed.

TYPICAL MULTI-PURPOSE TOOLS

Designed from your blueprints or sample and specifications
COMBINATION BORING, REAMING AND CHAMFERING HEADS
BORING AND FACING MILLS FOR RADIAL DRILLING
PILOTED TREPANNING AND REAMING TOOLS FOR DEEP HOLE WORK
GANG CUTTERS FOR SLAB-MILLING
CHROME-MOLY PLATES FOR PROP BLADES

BUILT WITH MORE BEEF IN THE BODY

To better take the punishment of carbide milling, O K tools, by virtue of their simple, two-component design, are huskier in the body, size for size; thus permitting closer blade spacing for close tolerance work, and heavier blades for hogging jobs. Blades are wedge-shape* blocks. Blades, once seated and driven home, never budge. Mated serrations prevent lateral movement; provide an accurate adjustment to compensate for wear. Grinding is minimized to .005" per blade by fine-tooth features. Bodies are not weakened with cutouts for locks, screws, pins, gibs or gadgets. Of these, O K can nicely do without.

FREE CATALOGS

"Modern Milling Cutters for Modern Milling Machines"
"America's First System of Insert Single Point Tools"

THE O K TOOL CO., INC.
Milford, New Hampshire

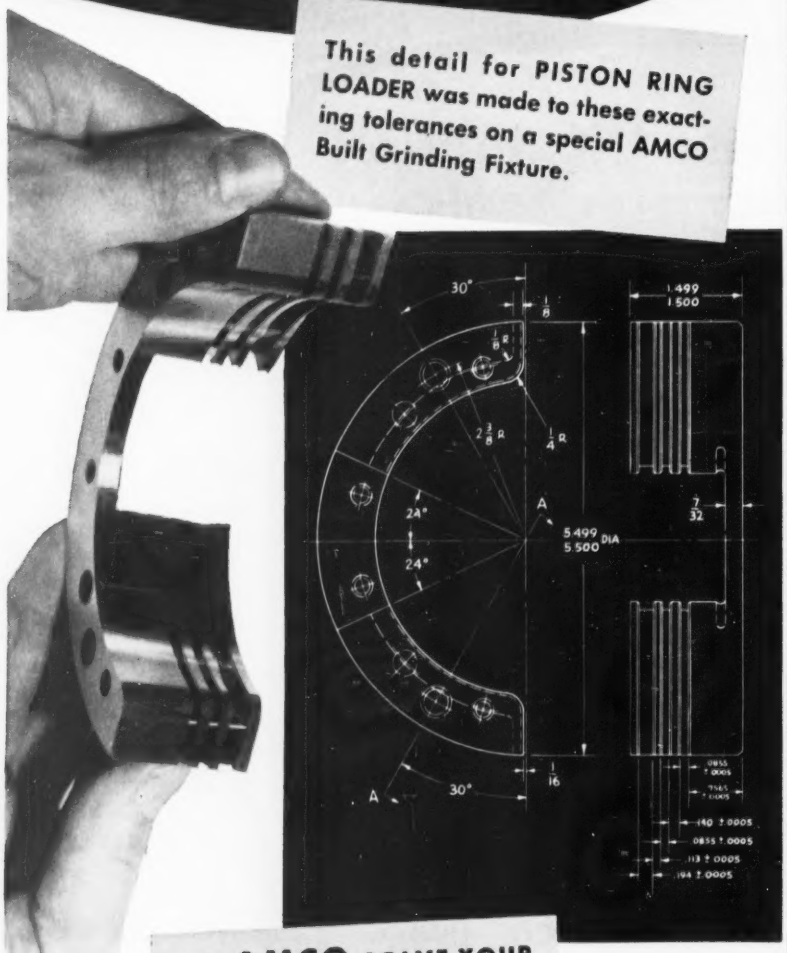
OK

modern milling cutters for modern milling machines

*The wedge is the world's strongest mechanical device

TOUGH TOLERANCES

TODAY'S FIXTURES require MICRO-INCH PRECISION to meet the needs of AUTOMATIC ASSEMBLY LINES



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MICRO-INCH PRECISION GAGES SINCE 1941

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CYLINDERS, Hydraulic

Barnes, John S., Corp., Rockford, Ill.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kiswaukee St., Rockford, Ill.
Tomkins-Johnson Co., Jackson, Mich.

DEALERS, Machinery

Botwinik Bros. of Mass., Inc., 14 Sherman St., Worcester, Mass.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
Ryerson, Jos. T., & Son, Inc. 2558 W. 16th St., Chicago 18, Ill.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.

DEMAGNETIZERS

Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Heald Mch. Co., 10 New Bond St., Worcester 6, Mass.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Inc., Worcester, Mass.

DESIGNERS, Machine and Tool

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Hartford Specialty Mchry. Co., 287 Homestead St., Hartford, Conn.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

DIAMONDS AND DIAMOND TOOLS

Smit, J. K., & Sons, Inc., Murray Hill, N. J.

DIE-CASTING

See Castings, Die

DIE-CASTING MACHINES

Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.

DIE CUSHIONS

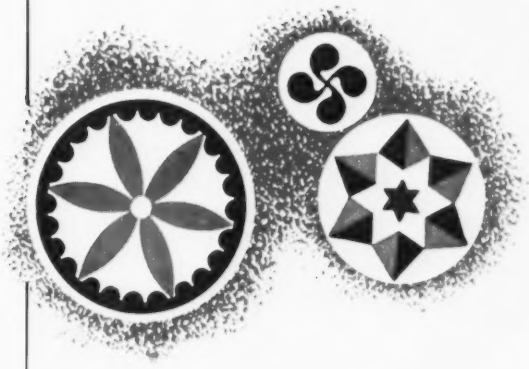
Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Clearing Mch. Corp., 6499 W. 65th St., Chicago, Ill.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.

DIE INSERTS, Carbide

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Kennametal Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

(*Continued on page* 344)

Do you believe in hex signs?



IN METALWORKING, THE PAYOFF'S AT AN R. D. WOOD PRESS LIKE THIS ONE!

This 3,000-ton hydraulic press is designed specifically for high-speed, heavy-duty die forging and ingot cogging. R. D. Wood presses are made for many uses, and in various sizes to suit production requirements. Ask for informative catalog, and for engineering aid—both yours without obligation.

In Pennsylvania Dutch country, the hex sign on the barn is mighty important. The farmer has confidence in its power to protect against evil. In the business world, customers believe in, and rely on, the name of the manufacturer. For instance—to people in metalworking, woodworking, rubber and plastics, the R. D. Wood name is a sign of real value in hydraulic presses . . . good presses that turn a profit for them year after year. To you as a buying influence, the 150-year-old Wood name can mean a lot, too. Economy and efficiency in production, for one thing. If you like, we'll send you a descriptive catalog.

R. D. WOOD COMPANY

PUBLIC LEDGER BUILDING • PHILADELPHIA 5, PENNSYLVANIA

Representatives in Principal Cities

MAKERS OF HYDRAULIC PRESSES AND VALVES

FIRE HYDRANTS

CAST-IRON PIPE

GATE VALVES

GAS PRODUCERS

ACCUMULATORS

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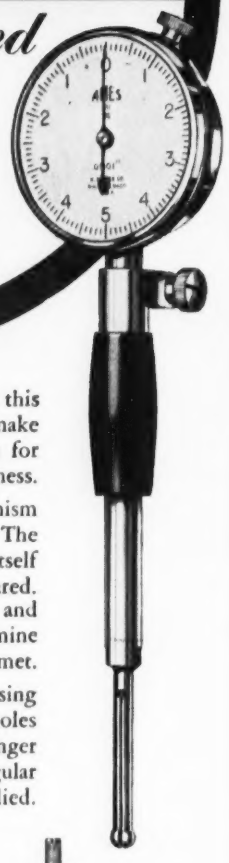
AMES

... the Preferred

FOR FAST, ACCURATE INSPECTIONS

Small Hole Gauge No. 36



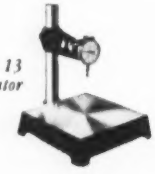
Skilled and unskilled employees can use this superbly designed two-point contact gauge to make quick, accurate, *impersonal* inspections of small holes for size, taper and roundness.

The Ames No. 36 has extremely sensitive mechanism especially designed to eliminate "feel" in measuring. The spherical contact point automatically centers itself and indicates the true diameter at the point measured. The operator has only to slide the contact in and around the hole and note the readings to determine if tolerances are being met.

The Ames Small Hole Gauge No. 36, using contacts in increments of 1/32", can check holes of 3/16" to 1" diameter, up to 2" depth. Longer lengths and special contacts to check irregular recesses, splines, etc., can be supplied.

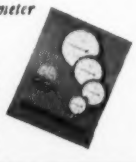
Ames No. 15 Jaw Gauge

Ames No. 13 Dial Comparator



Ames No. 516 Dial Micrometer

Ames No. 25 Pocket Thickness Measure



If you would like to have our recommendations on your measurement problem, send blueprints and specifications. Write for your free copy of catalog on Ames precision measuring instruments.

Representatives in principal cities. B. C. AMES CO. *27 Ames Street, Waltham 54, Mass.*

Mfgr. of Micrometer Dial Gauges • Micrometer Dial Indicators

DIEMAKERS' SUPPLIES

Allied Products Corp., 12677 Burt Rd., Detroit 23, Mich.
Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DIEMAKING MACHINES

Grob, Inc., Grafton, Wis.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
Oliver Instrument Co., 1410 E. Moumee St., Adrian, Mich.

DIE SETS, Standard

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 N. 18th St., Ampere, N. J.

DIE-SINKING MACHINES

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Gorton, George, Machine Co., 1110 W. 13th St. Racine, Wis.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.

DIE-SINKING PRESSES

Baldwin-Lima-Hamiliton Corp., Philadelphia 42, Pa.
Kearney & Trecker Corp., Milwaukee, Wis.

DIE STOCKS

See Stocks, Die

DIES, Sheet Metal, Etc.

Allied Products Corp., 12677 Burt Rd., Detroit 23 Mich.
Bliss, E. W., Co., 1375 Raff Rd., S. W. Canton, Ohio.
Carboloy Dept. General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chambersburg Engrg. Co., Chambersburg, Pa.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Dreis & Krupp Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Mch. Co., Bridgeton, N. J.
John B., Manufacturing Co., Ellis St., New Britain, Conn.
Metal Carbides Corp., Youngstown, Ohio.
Niagara Mch. & Tool Wks. 683 Northland Ave., Buffalo, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Waltham Mch. Wks., Newton St., Waltham, Mass.
Winzeler Mfg. & Tool Co., 1712 West Arcade Pl., Chicago 12, Ill.

DIES, Threading

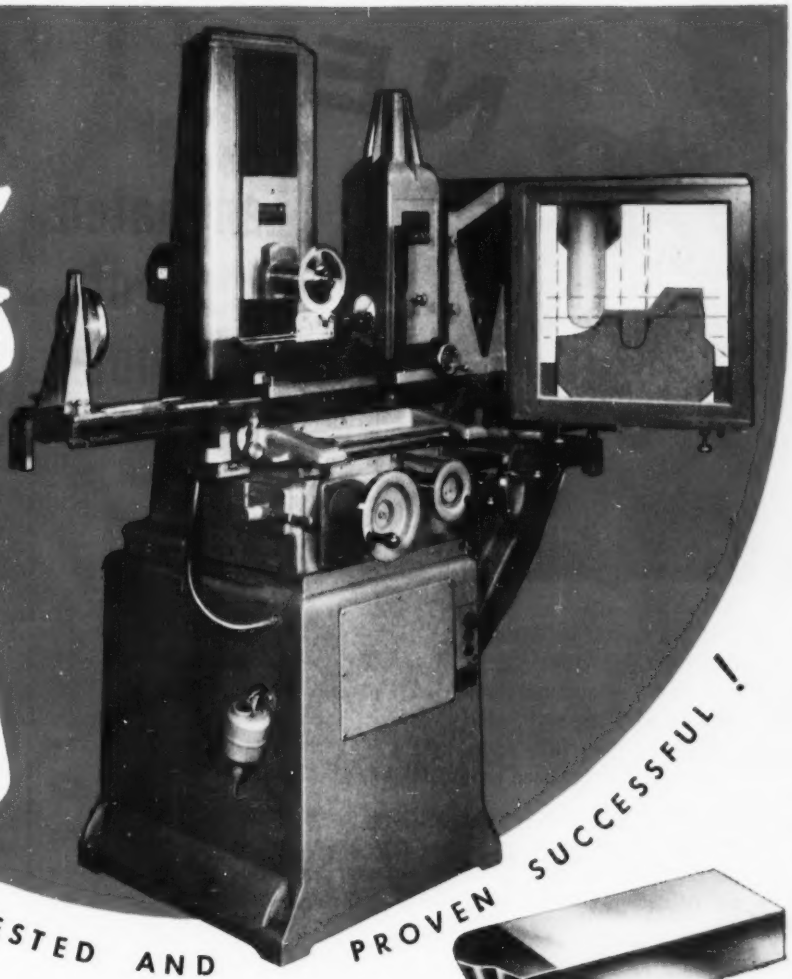
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg., Mansfield, Mass.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
Eastern Mch. Screw Corp., New Haven, Conn.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Winter Bros. Co., Rochester, Mich.

(*Continued on page* 346)

For more information on products advertised, use Inquiry Card, page 265

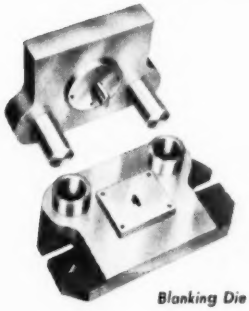
Positive Results with VISUAL GRIND

TRADE MARK

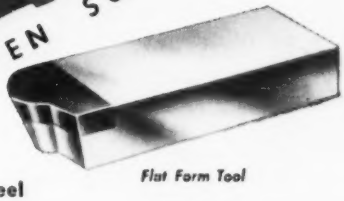


TESTED AND PROVEN SUCCESSFUL !

Progressive Die

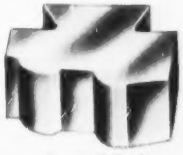


Blanking Die



Flat Form Tool

Circular Form Tool



Dovetail Tool

Here is precision contour grinding at its best. Steel and tungsten carbide form tools, die sections, templates and related items are efficiently processed in dependable, economical fashion. Our basic magnetic chuck work-holder affords positive positioning yet with flexibility for cam, circular and index grinding with the proper fixtures. Workpiece quality is controlled visually at all stages, either while using pre-dressed grinding wheels or when generating the required contour by means of successive, controlled movements. Durable construction around precision optics insures rigidity and long life.

Ask for Bulletin "M-4"

VISUAL GRIND

THE CLEVELAND GRINDING MACHINE COMPANY

1643 EDDY ROAD • CLEVELAND 12, OHIO

New Possibilities in Optical Grinding

NEW!

Laminated Shims of Aluminum

with all laminations surface-bonded

This new type of laminated shim brings you all the advantages of aluminum – light weight, freedom from corrosion and electrolytic action – in shims that P-E-E-L quickly and smoothly for adjustment. They're bonded over their entire surfaces and are made just as carefully and expertly as the brass and steel laminated shims we've been producing for over 40 years.

Laminated aluminum is available either as shims custom-stamped to your blueprint specifications or as laminated sheet stock in thicknesses from .015" to .125", sizes to 20" x 48". Stocks are maintained on both the East and West Coasts.

For free sample of material, further information and prices, please write us direct.

ALUMINUM LAMINATED SHIMS

they look "solid"

yet p-e-e-l for adjustment

SHIM HEADQUARTERS SINCE 1913

LAMINATED SHIM COMPANY, INC.

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CUSTOM SHIMS STAMPINGS SHIM STOCK

DIES, Threading, Opening

Eastern Mch. Screw Corp., New Haven, Conn.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Geometric Tool Co. Westville Station, New Haven 45, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

DIES, Thread Rolling

Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

DISCS, Abrasives

Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.
Smit, J. K. & Sons, Inc., Murray Hill, N. J.
Walls Sales Corp., 333 Nassau Ave. Brooklyn 22, N. Y.

DISINTEGRATORS

Elox Corp., 602 N. Rochester Rd., Clawson, Mich.

DIVIDING HEADS

See Indexing and Spacing Equipment

DOWELL PINS

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
DoAll Co., 254 N. Laural Ave., Des Plaines, Ill.
Producto Machine Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DRAFTING MACHINES

Universial Drafting Mach. Corp., 7960 Lorain Ave., Cleveland, Ohio.

DRESSERS, Grinding Wheel

Carboloy Dept., General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plains, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hoglund Engrg. & Mfg. Co., Inc., Berkeley Heights, N. J.
Metal Carbides Corp., Youngstown, Ohio.
Meyers, W. F. Co., Bedford, Ind.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Vinco Corp., 9113 Schaefer Hwy., Detroit 28, Mich.

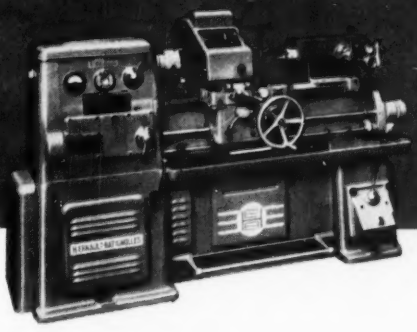
DRIFTS, DRILL

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

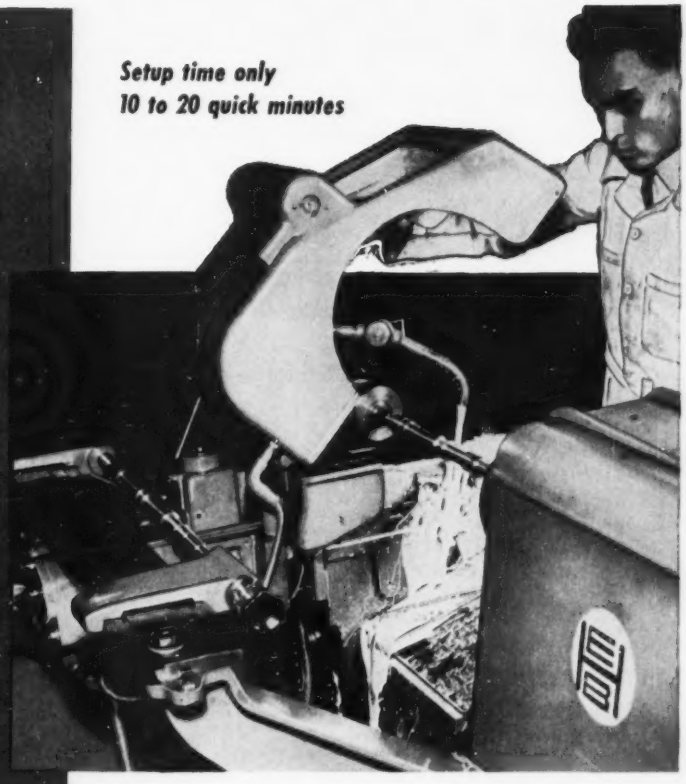
(*Continued on page* 348)

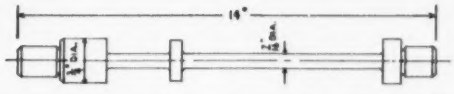
the MACHINE FOR TURNING AIRCRAFT PARTS

high speed HYDRAULIC COPYING LATHES



Setup time only
10 to 20 quick minutes





Typical part (drive-shaft) turned on the H.E.B. OP-320 Copying Lathe. Machined from SAE 1040 bar; floor-to-floor time just 2.1 minutes.

MORE H.E.B. HIGHLIGHTS

- Great rigidity for high speed turning.
- Spindle speeds 50-3600 RPM in 20 small increments.
- Ample power – 20 HP is standard.
- Finish to 32 micro inches.
- Copyturns within .001" diameter; holds .0005" diameter with rear tool.
- Copies greater range of parts because cross slide is perpendicular to work.

ASK ANY AIRCRAFT PRODUCTION ENGINEER what features he hopes to find in the "lathe of his dreams" and he's sure to list those built into the H.E.B. OP-320. This great copying lathe with its sensitive *built-in* tracer device does in a handful of seconds what other machines do in many minutes. Because of its amazing finish and accuracy it saves on grinding costs, often eliminating the operation completely.

Right now, many famous plants throughout the U. S. and the world depend on the H.E.B. to turn parts for jet engines, guided missiles and other aircraft requirements. It pays for itself in a few months whether the lots are large or small.

You've got to *see* the H.E.B. in action! Until you do you can't believe such performance is possible. Ask for a demonstration now, or for detailed literature . . . There's also the H.E.B. PILOT, for completely automatic turning.

H.E.B. MACHINE TOOLS, INC.

475 Fifth Avenue, New York 17, N. Y. • LExington 2-0266

COPYING LATHES • ENGINE LATHES WITH COPYING ATTACHMENTS • CARBIDE TOOL GRINDERS • RADIAL DRILLS

H·E·B

"THE WAY TO TURN"

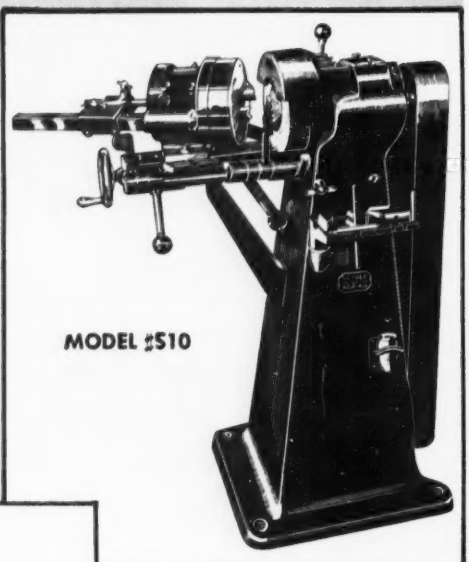
Grind Drills to

Cut Faster • Last Longer
Produce More Accurate Holes

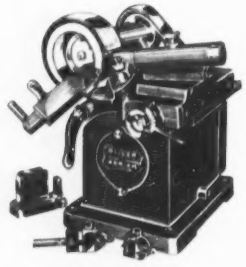
with OLIVER DRILL POINTERS

To obtain best results from your twist drills, you must use correctly sharpened drills. Twist drills *machine-ground* the Oliver Way assure uniformity, last from 2 to 3 times longer than hand-ground drills. The balanced cut obtained with OLIVER DRILL POINTERS means that each lip of the drill does equal work — makes more perfect holes.

Dull drills are costly — cause rejects and production lags. Avoid excessive drill costs and imperfect holes. Save time and money the *Oliver Way* . . . At the first sign of dullness or inaccuracy, remove twist drills from the drilling machine . . . increase their wearing life and efficiency . . . *machine-grind* them with OLIVER DRILL POINTERS.



MODEL ‡510



MODEL ‡21

OLIVER DRILL POINTERS
give you the only scientifically correct and theoretically perfect drill point.

OLIVER OF ADRIAN

No. 510 for drills ¼" to 3"—2-3-4 flute. Variable clearances. Variable point angles. Automatic operation.
No. 21 Oliver Bench Grinder. Hand operated for Drills No. 57 to ½". Right hand, with an improved point. Attachments are available for grinding oil hole drills, left hand and other special points.

Write for our free Booklet
"How To Produce More Holes With Your Drills!"
See our catalog in Sweet's Directory

OLIVER INSTRUMENT CO.
1410 E. MAUMEE • ADRIAN, MICHIGAN

MACHINE TOOLS by OLIVER include:
AUTOMATIC DRILL GRINDERS
TOOL & CUTTER GRINDERS
DRILL POINT THINNERS
TEMPLATE TOOL GRINDERS
FACE MILL GRINDERS
DIE MAKING MACHINES

DRILL HEADS, Multiple Spindle

Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Etto Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, Mich.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 Lafayette, Detroit 7, Mich.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
United States Drill Head Co., 616 Burns, Cincinnati, Ohio.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILL HEADS, Unit Type

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Keller Tool Co., Grand Haven, Mich.
Kingsbury Mch. Tool Corp., Keene, N. H.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., Inc., 946-H Harriet St., Cincinnati 3, Ohio.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.

DRILL SOCKETS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL STANDS

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLING MACHINES, Automatic

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bodine Corp., Mt. Grove St., Bridgeport, Conn.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Kingsbury Mch. Tool Corp., Keene, N. H.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., 946-M Harriet St., Cincinnati 3, Ohio.

(*Continued on page 350*)

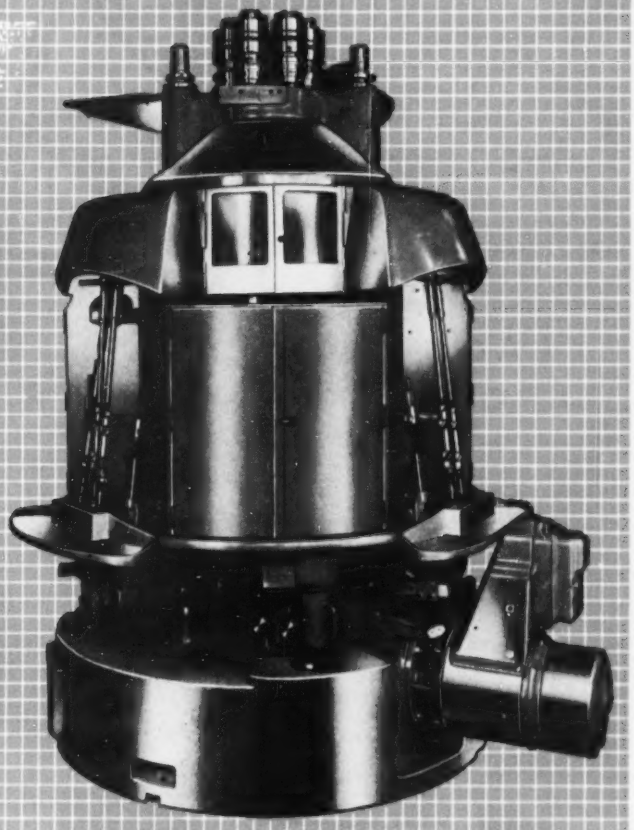
For more information on products advertised, use Inquiry Card, page 265

TAYANNES

GYROMATIC

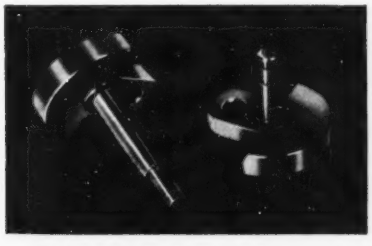
VERTICAL

SIX ROTATING SPINDLES
SIX TOOL SLIDES
AUTOMATIC LOADING

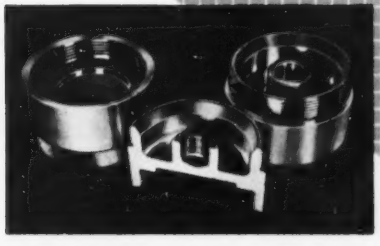


AUTOMATIC CHUCKING MACHINE

Instrument Accuracy



CHROME-NICKEL FORGING
Interrupted Cut



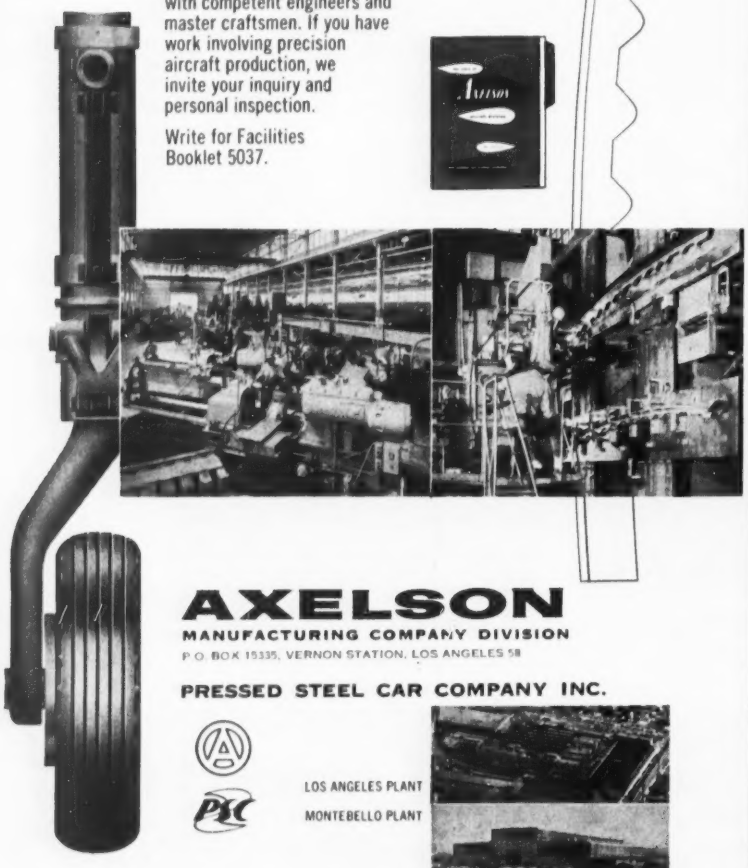
ALUMINUM DIE CASTING
Single Point Automatic Threading

RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.

Axelson aircraft components, including landing gear shock struts, gears, geared mechanisms, segments, spars, braces and other plane structural parts, are serving throughout the world in both military and commercial planes. Axelson's facilities are among the largest and most modern; it is staffed with competent engineers and master craftsmen. If you have work involving precision aircraft production, we invite your inquiry and personal inspection.

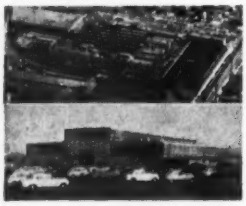
Write for Facilities Booklet 5037.



AXELSON
MANUFACTURING COMPANY DIVISION
P.O. BOX 15335, VERNON STATION, LOS ANGELES 58

PRESSED STEEL CAR COMPANY INC.

LOS ANGELES PLANT
MONTEBELLO PLANT



National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILLING MACHINES, Bench

Avey Drilling Mch. Co., 126 E. Third St., Covington, Ky.
Boice-Crane, 941 W. Central Ave., Toledo, Ohio.
Buffalo Forge Co., 490 Broadway, Buffalo.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Walker-Turner Div., Kearney & Treckar Corp., 900 North Ave., Plainfield, N. J.

DRILLING MACHINES, BOILER

Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland.

DRILLING MACHINES, Deep Hole

Avery Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.

DRILLING MACHINES, Gang

Avery Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.

DRILLING MACHINES, Horiz. Duplex

Avery Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes W. F. & John Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Edlund Machinery Co., Cortland, N. Y.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Kingsbury Mch. Tool Corp., Keene, N. H.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.

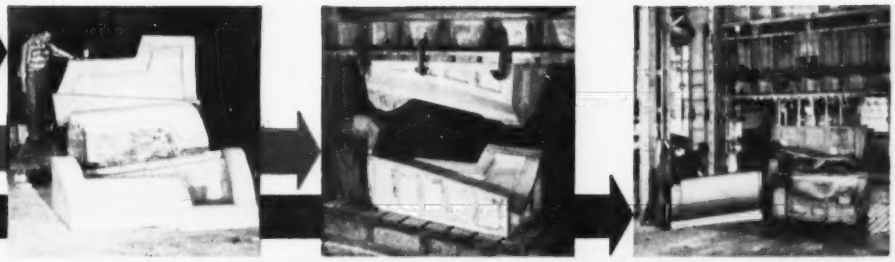
(Continued on page 354)

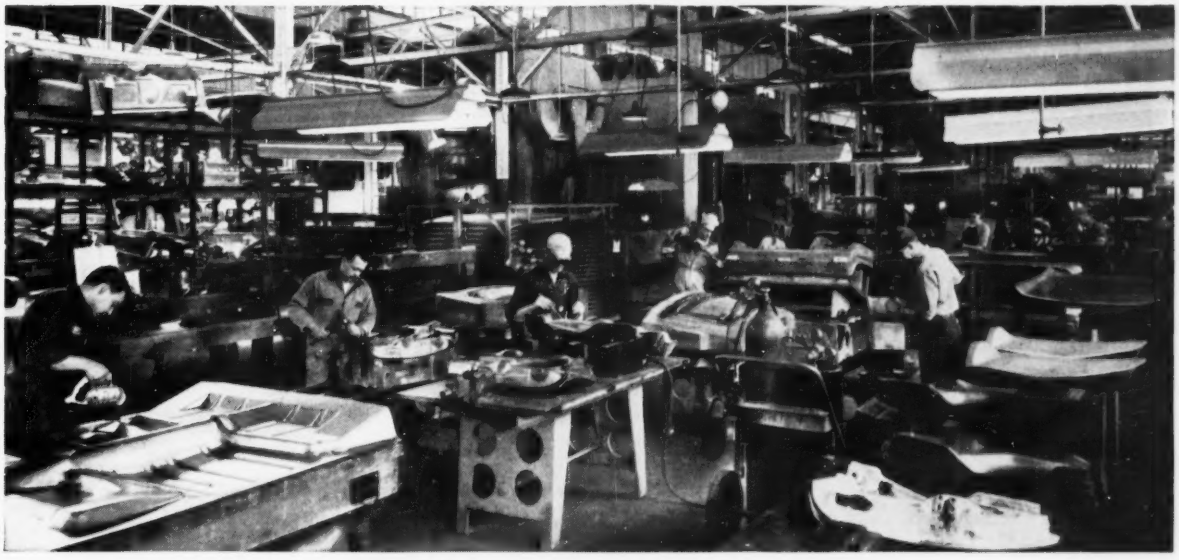
For more information on products advertised, use Inquiry Card, page 265

The PATTERN

The DIE

The STAMPING





. . . to Completely Finished PROTOTYPE PARTS READY FOR ASSEMBLY

It's Allied that offers the *complete* service to provide you with die-made prototype parts.

Plaster patterns . . . low-cost, quickly-produced dies made of plastic or zinc alloy . . . stampings accurately drawn and formed on Allied presses . . . completed parts which have been hand trimmed, flanged, pierced and spot finished . . . are all produced by Allied.

Not only is full responsibility for such a prototype program centered at one source but many economies can be effected from which you as a customer can benefit. In the building of the dies, for example, combinations of plastic, zinc alloy or steel (all of which Allied supplies) give you the best and most economical tooling for your volume requirements. In the finishing processes, as one more example, the tools themselves are often used for flanging and other purposes—additional cost-saving and accuracy-assuring operations.

If you need sheet metal stampings for prototype assemblies, you should investigate Allied's all-inclusive service. A visit to our Plant 4 in Hillsdale, Michigan will convince you that here is a positive method of insuring an economical and rapid transition from prototype to high volume production. If a visit is not convenient, let us supply you with complete information.

Other Allied Products

SPECIAL COLD FORGED PARTS • STANDARD CAP SCREWS • HARDENED AND PRECISION GROUND PARTS • R-B INTERCHANGEABLE PUNCHES AND DIES

PRECISION • EXPERIENCE • DEPENDABILITY

ALLIED CORPORATION PRODUCTS

ALLIED PRODUCTS CORPORATION

DEPT. D-19 • 12619 BURT ROAD • DETROIT 23, MICH.

PLANT 1
Detroit, Mich.

PLANT 2
Detroit, Mich.

PLANT 3
Hillsdale, Mich.

PLANT 4
Hillsdale, Mich.

For more information on products advertised, use Inquiry Card, page 265

THERE'S A LOW PRICE TAG

Air Gaging need not be expensive. Use it when air best fits the job.

Feature for feature, the Dimensionair offers more than you ever can know until you use it.

Have you seen the new AirProbe? NO tolerance setting masters required!

ON AIR GAGING!

If you find your gaging requirements are best met with AIR GAGES, it's to your best interest to investigate the simplicity and economy of FEDERAL Air Gages.

For instance, any of the regular air gage attachments can be used on the same Dimensionair without complicated adjustments. Such attachments as air plugs, rings, AirProbes, adjustable bore gages, air snaps, and all special designed attachments are readily interchangeable on the same air gage—AND YOU NEED ONLY ONE MASTER. Moreover, when you realize the reasonable low cost of the Dimensionair and its accessories, and when you realize the economy of maintaining and adapting it to any future need, the true economy of the Federal Dimensionair becomes strikingly apparent. If you have not recently investigated and compared the costs of Federal Air Gage equipment, we believe you will be pleasantly surprised.

And remember, with the Federal Dimensionair you get THE REALLY EXCEPTIONAL FEATURES not available in other air gages —longer measuring range per magnification, greater plug clearance and longer life, deeper and larger jets, direct reading accuracy, and stable performance. Ask any man who has used both the Dimensionair and other air gages. *He* ought to know! Federal Products Corporation, 4117 Eddy Street, Providence 1, Rhode Island.

Ask **FEDERAL**

FOR ANYTHING IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting or Automatically Controlling Dimensions on Machines

In a four month period under actual competitive conditions one Diamond Wheel ground 36,976 pieces, while eight silicon carbide wheels ground a total 16,023 pieces.

RESULT— 1. Less cost per piece 2. Greater Production 3. Less down time.

See for yourself how

SECOMET DIAMOND WHEELS

can provide you with these plus values

Send for informative catalog #54 or contact us direct for information and assistance.

SUPER MATERIAM IGNIS TRIUMPHANS

J. K. SMIT & SONS, INC.

MURRAY HILL, N. J.

Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

DRILLING MACHINES, Horizontal Portable

Avery Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.

DRILLING MACHINES, Inverted

Avery Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

DRILLING MACHINES, Multiple Center Column Type

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.

DRILLING MACHINES, Multiple Spindle

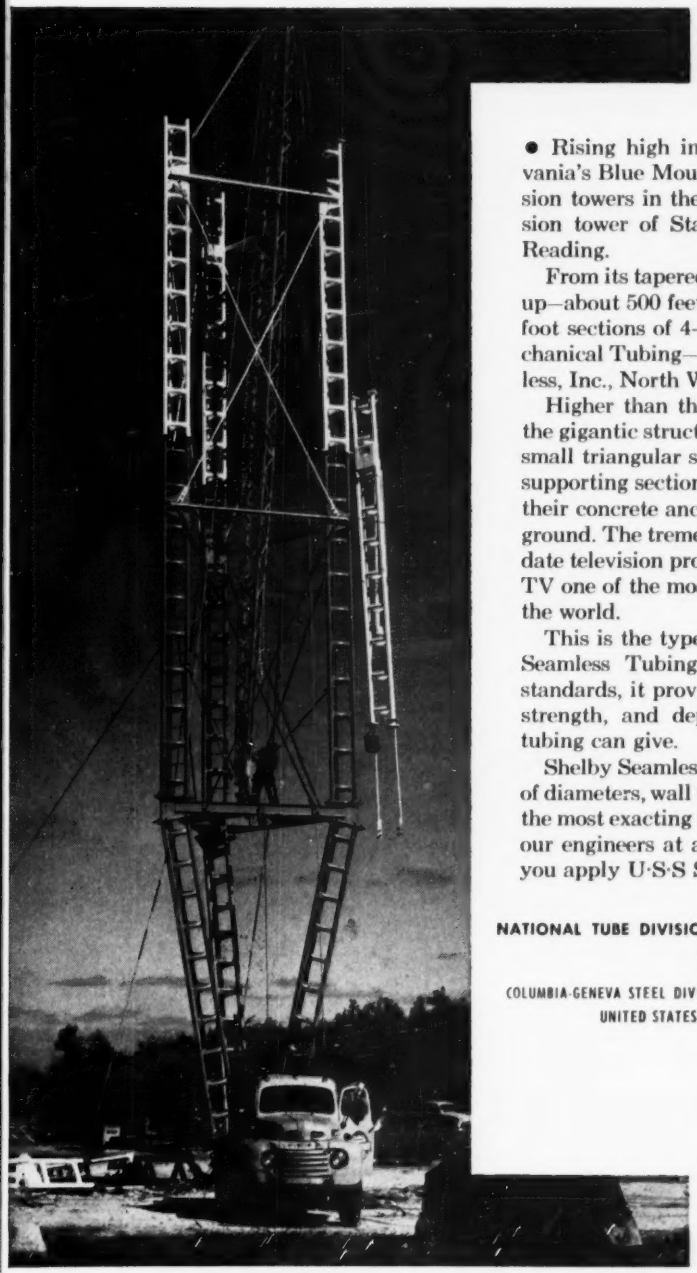
Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Burg Tool Mfg. Co., 3743 Durango Ave., Los Angeles 34, Cal.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Cosa Corp., 405 Lexington Ave., New York 17.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Greenlee Bros. & Co., 12th and Columbia Ave., Rockford, Ill.
Hartford Special Mchry, Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

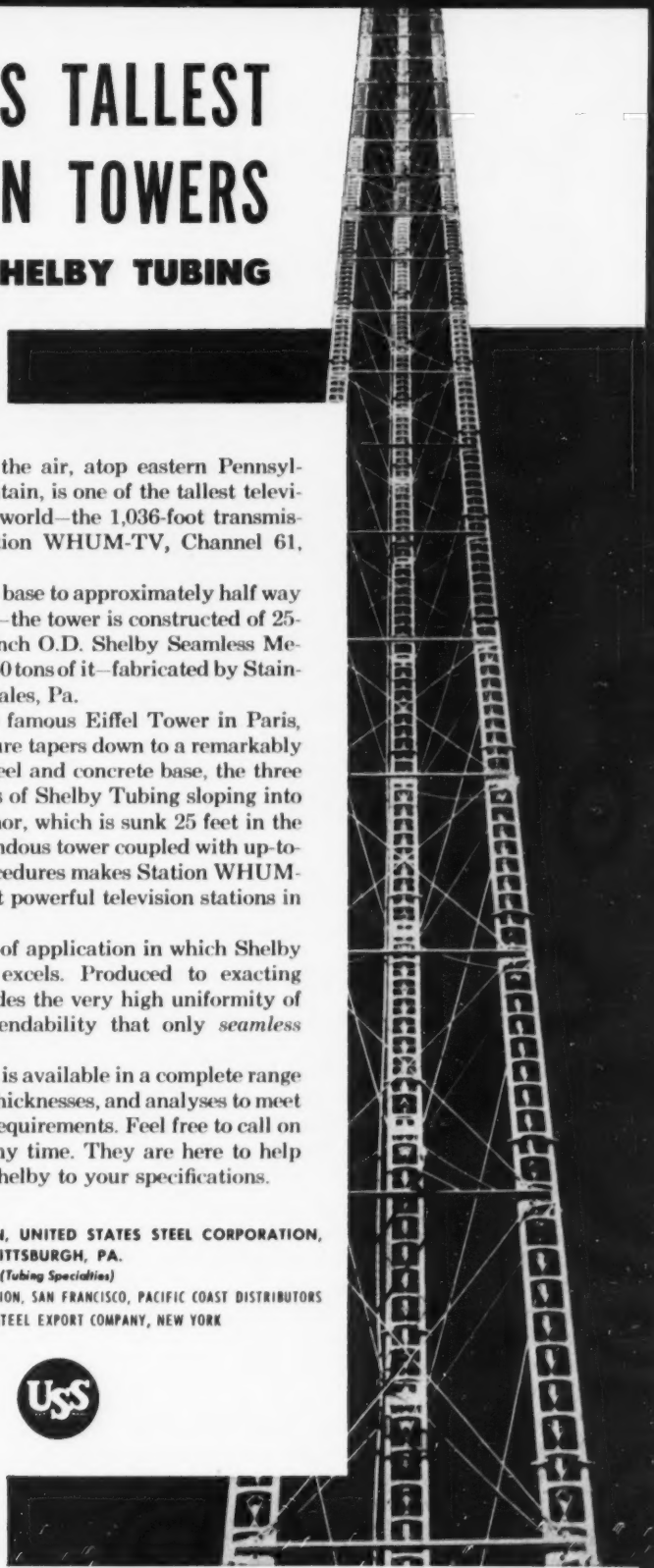
(*Continued on page 356*)

For more information on products advertised, use Inquiry Card, page 265

ONE OF THE WORLD'S TALLEST TELEVISION TOWERS

RESTS ON 50 TONS OF SHELBY TUBING





• Rising high in the air, atop eastern Pennsylvania's Blue Mountain, is one of the tallest television towers in the world—the 1,036-foot transmission tower of Station WHUM-TV, Channel 61, Reading.

From its tapered base to approximately half way up—about 500 feet—the tower is constructed of 25-foot sections of 4-inch O.D. Shelby Seamless Mechanical Tubing—50 tons of it—fabricated by Stainless, Inc., North Wales, Pa.

Higher than the famous Eiffel Tower in Paris, the gigantic structure tapers down to a remarkably small triangular steel and concrete base, the three supporting sections of Shelby Tubing sloping into their concrete anchor, which is sunk 25 feet in the ground. The tremendous tower coupled with up-to-date television procedures makes Station WHUM-TV one of the most powerful television stations in the world.

This is the type of application in which Shelby Seamless Tubing excels. Produced to exacting standards, it provides the very high uniformity of strength, and dependability that only *seamless* tubing can give.

Shelby Seamless is available in a complete range of diameters, wall thicknesses, and analyses to meet the most exacting requirements. Feel free to call on our engineers at any time. They are here to help you apply U·S·S Shelby to your specifications.

NATIONAL TUBE DIVISION, UNITED STATES STEEL CORPORATION, PITTSBURGH, PA.
(Tubing Specialties)
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS

THE TOWER WAS ERECTED in 25-foot sections—each section alternately painted red and white. In an average 8-hour work day, the crew completed ten sections.

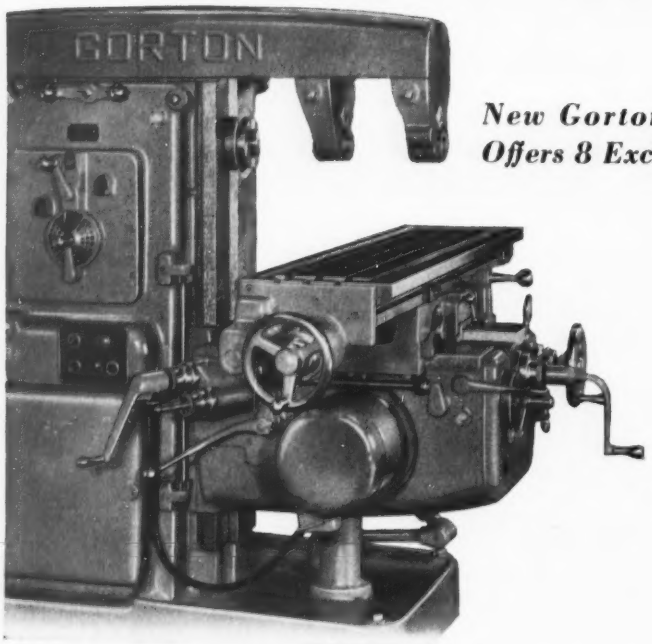
TRANSMISSION TOWER, Station WHUM-TV Reading. Steel guy wires, 1¼ inch dia., are attached to the tower at consecutive 175-foot levels, and are anchored in concrete 400 feet and 800 feet from the structure in all directions. Aircraft warning lights are also located at 175-foot levels.

WALLS WITHOUT WELDS

U·S·S SHELBY SEAMLESS MECHANICAL TUBING

UNITED STATES STEEL

New Concept in Milling



New Gorton Mill Offers 8 Exclusives

"First completely new design in years," say engineers who have seen demonstrations of the Gorton 2-28 Horizontal mill — a heavy-duty, high-speed-spindle machine suitable for carbide milling.

Square-lock bearings and a 24½-inch bearing spread on the knee provide extreme table rigidity. Even under heavy cutting loads, the table remains rigid. There can be no sag or twist.

The new Gorton Horizontals have, in addition to conventional spindle lubrication, a device that floods spindle bearings with 120 extra gallons of oil per hour. This method of cooling and lubricating dissipates spindle bearing heat throughout the column.

Net results are a marked reduction of spindle "growth" at the nose and, with only two driving gear contacts at any speed, more motor horsepower is usable at the spindle. This is a decided advantage over machines having more gears in contact and which do not dissipate spindle bearing heat as described.

A choice of three spindle speed ranges is available: 50 to 2000 rpm for carbide milling; 28 to 1100 rpm for conventional milling, or 25 to 2000 rpm for maximum work scope.

Double overload protection for cutters and gears stops all feeds when, for any reason, the cutter becomes overloaded or jammed. One is mechanical, the other electrical.

True unit construction drastically reduces down time and maintenance services. A removable coolant pan permits quick interchange of coolants and speeds sump clean-out.

A horsepower-load meter indicates cutter condition and records machine operating efficiency.

Complete information on the new, reasonably priced line of 2-28 Horizontals is available from the manufacturer, George Gorton Machine Co., 1307 Racine St., Racine, Wis., U.S.A.

Eight Gorton Exclusives Open New Era in Milling

1. **24½-inch knee**
2. **Oil-bath cooling of spindle bearings**
3. **Maximum horsepower at spindle nose**
4. **Spindle speeds from 25 to 2000 rpm**
5. **Double-overload protection for cutters**
6. **True unit construction**
7. **Removable coolant pan**
8. **Horsepower-load meter**

Motors available: 7½, 10 or 10/5 hp.

South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILLING MACHINES, Radial

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Carlton Mch. Tool Co., 3000 Spring Grove Ave., Cincinnati 25, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Foot-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Kaukauna Machine Corp., Kaukauna, Wis.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

DRILLING MACHINES, Rail

See Drilling Machines, Gang

DRILLING MACHINES, Sensitive

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Foot-Burt Co., 1300 St. Clair Ave., Cleveland, 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

DRILLING MACHINES, Upright

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Mch. Tool Co., 156 Wason Ave., Springfield 7, Mass.
Boice-Crane, 941 W. Central Ave., Toledo, Ohio.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Edlund Machinery Co., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Moline Tool Co., 102 20th St., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Orban Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

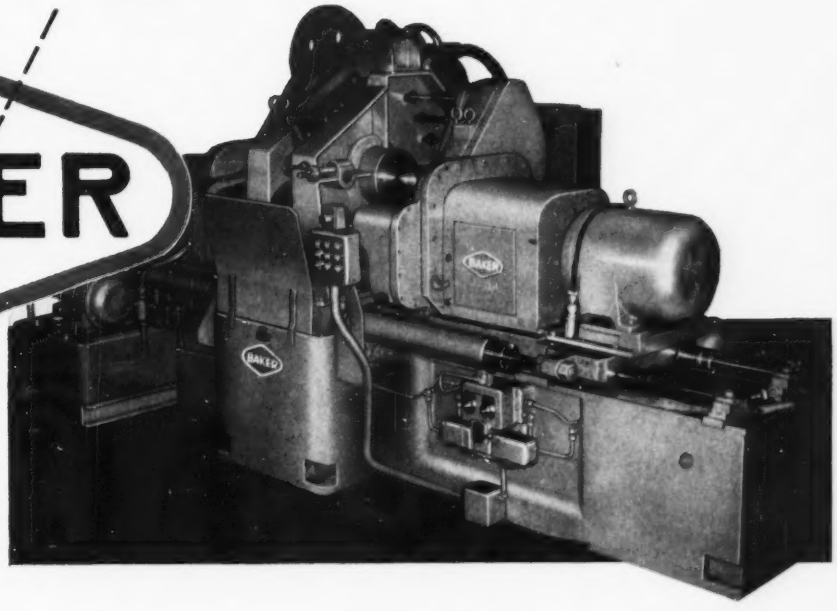
(*Continued on page 358*)

For more information on products advertised, use Inquiry Card, page 265

Modern Machine Tools..

SLASH PRODUCTION COSTS!

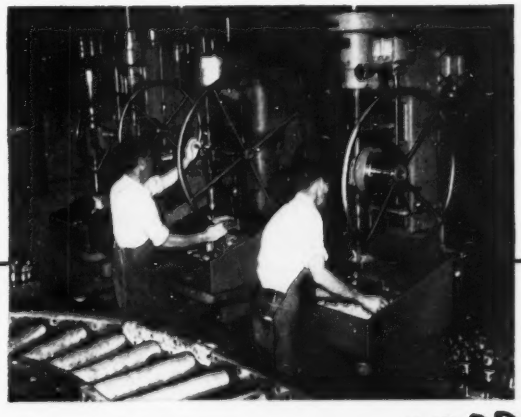
New
BAKER
Method



1 Operator . . .
1 Machine . . .

Multi-Operations Fully Automatic On 4 Parts Simultaneously—Load—Drill—Core Drill—Ream—Unload

THE OLD METHOD —



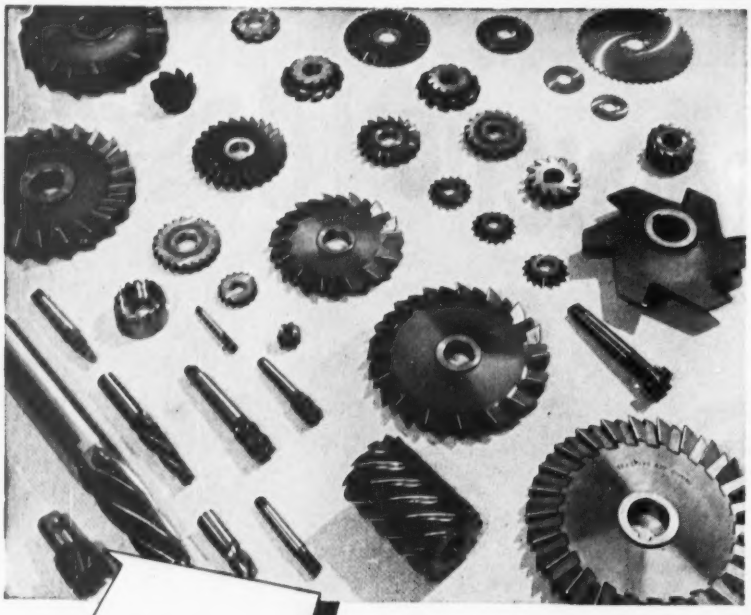
2 OPERATORS . . 4 MACHINES . .

Hand Controls + Excessive Handling + Capstan And Hand Engagement Of Feed + Operator Fatigue = Low Production Rate At High Cost.

INCREASE PRODUCTIVITY . . with a NEW BAKER 'Special'

WRITE REGARDING YOUR SPECIFIC JOB PROBLEMS...

BAKER BROTHERS, INC. Toledo, Ohio
DRILLING...TAPPING...KEYSEATING and CONTOUR GRINDING MACHINES



THE *Complete Line*

GORHAM

END MILLS AND MILLING CUTTERS

For profitable solutions to production milling problems, call on Gorham! Over thirty years' experience in creating fine cutting tools is your assurance of satisfaction.

An extensive line of *standard* end mills and milling cutters is stocked by Gorham distributors. When you need *special* tooling, a Gorham Field Engineer surveys your problem and makes design recommendations for a tool to be "tailor-made" for your application by skilled Gorham craftsmen.

Ask your distributor for Gorham "standards." For "specials," call in your nearby Gorham Field Engineer. They're both well qualified to help you . . . and backed by unmatched experience and facilities. For profitable solutions to milling problems, call on Gorham! There's no obligation.

Write for free 120 page catalog. Shows entire line, contains valuable engineering information.

Gorham TOOL COMPANY

"EVERYTHING IN STANDARD AND SPECIAL CUTTING TOOLS"

14405 WOODROW WILSON • DETROIT 3, MICHIGAN

WEST COAST WAREHOUSE: 576 North Prairie Ave., Hawthorne, Calif.

Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Ryerson, Jos. T. & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

DRILLING MACHINES, Wall, Radial

Cleveland Punch & Shear Works., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.

DRILLS, Center

Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Keo Cutters, 19326 Woodward, Detroit, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Core

Corboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
McCosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Super Tool Co., 21650 Hoover Rd. Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

DRILLS, Deep Hole

Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Portable Electric

Black & Decker Mfg. Co., Towson, Md.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Millers Falls Co., Greenfield, Mass.
Ryerson Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

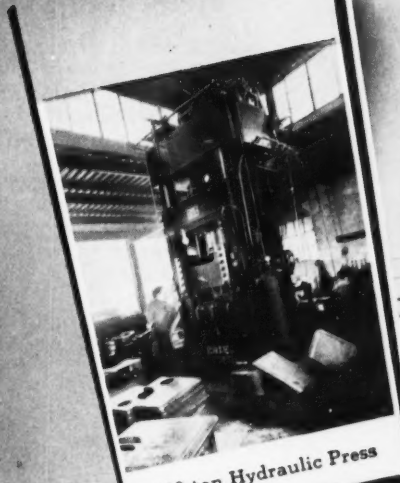
DRILLS, Portable Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St. New York 9, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

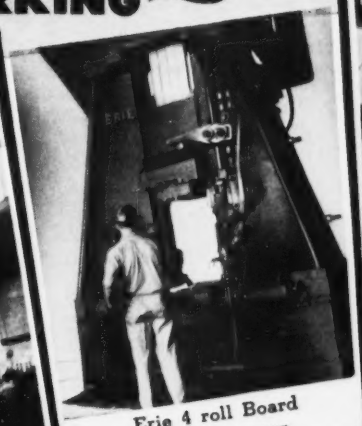
(*Continued on page* 360)

For more information on products advertised, use Inquiry Card, page 265

DIVERSITY OF EQUIPMENT for METAL WORKING



500 ton Hydraulic Press

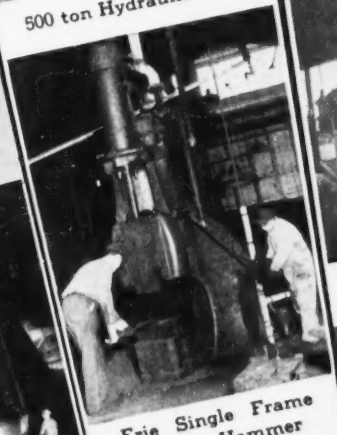


Erie 4 roll Board Drop Hammer

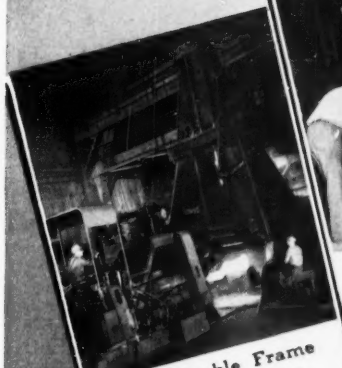
Erie 25,000 lb. Steam Hammer

2 roll Board Drop Hammer

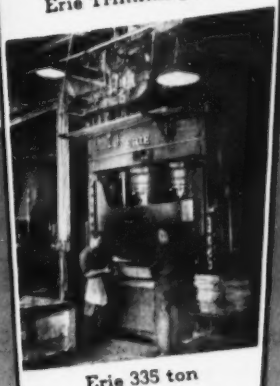
Erie Trimming Press



Erie Single Frame Forging Hammer



Erie Double Frame Forging Hammer



Erie 335 ton Hydraulic Press

FOR more than half a century Erie Foundry Company has served the metal-working industry with top performance steam and air operated hammers, board drop hammers, double and single frame forging hammers, trimming presses and hydraulic presses. Before making your selection consult with our engineers.

Bulletins on all of these products are yours on request.

ERIE

ERIE FOUNDRY COMPANY ERIE, PENNSYLVANIA

Dependable **FORGING HAMMERS • HYDRAULIC PRESSES**

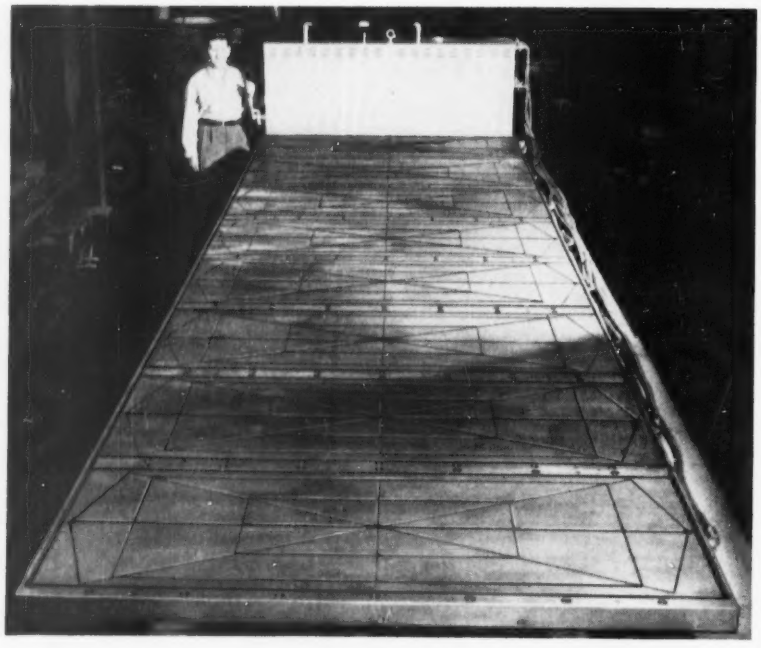
DRILLS, Rachet
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago III.
Chicago-Latrobe Twist Drill Works 411 W. Ontario St., Chicago, III.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twist Drill Co., Athol, Mass
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Twist
Besley-Welles Corp., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, III.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, III.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Wire
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago III.
Greenfield Tap & Die Corp. Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRIVES, Chain
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.

Walker Does It Again-



Walker, pioneer in the chuck industry, has been utilizing magnetic force to make all types of special and standard chucks since 1887.

Walker now harnesses atmospheric force for special vacuum chucks to hold non-magnetic materials. First a leader in magnetic force—now a pioneer in atmospheric force.

Hold Everything with Walker Chucks

O. S. WALKER CO. Inc.
WORCESTER 6, MASSACHUSETTS
Original Designers and Builders of Magnetic Chucks

DUPLICATORS
Gorton, George, Mch. Co. 1110 W. 13th St., Racine, Wis.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Richford Mch. Tool Co., 2500 Kishwaukee St., Rockford, III.

DUST COLLECTORS
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Pangborn Corp., Hagerstown, Md.

DUST CONTROL SYSTEMS
Pangborn Corp., Hagerstown, Md.

ELECTRICAL EQUIPMENT
General Electric Co., Schnectady 5, N. Y.

EMERY WHEEL DRESSERS
See Dressers, Grinding Wheel

EMERY WHEELS
See Grinding Wheels

ENGRAVING MACHINES
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.

EXTRACTORS, Screw
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

FACING MACHINES
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.

FANS, Exhaust, Electric Ventilating
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
General Electric Co., Schenectady 5, N. Y.

FEEDS FOR PRESSES, Automatic
Federal Press Co., 600 Division and Big Four R. R. Elkhart, Ind.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

FELT, For All Applications
American Felt Co., Glenville, Conn.

FILES, Hack
DoAll Co., 254 Laural Ave., Des Plaines, III.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES, Hand
DoAll Co., 254 Laurel Ave., Des Plaines, III.
Heller Bros. Co., Newcomerstown, Ohio.
Nicholson File Co., 23 Acorn St., Providence, R. I.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES Machine
DoAll Co., 254 Laurel Ave., Des Plaines, III.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

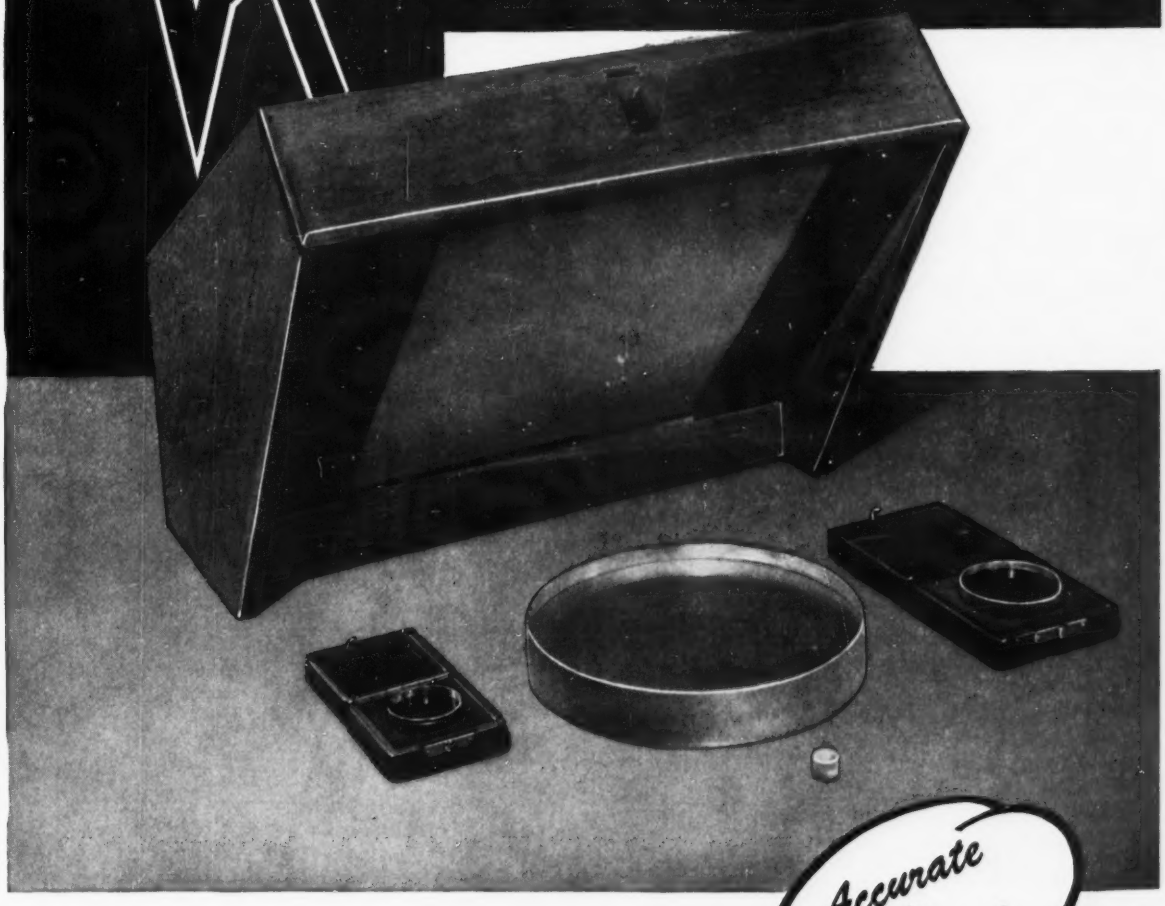
FILES AND BURS, Rotary
Atrax Co., Newington, Conn.
DoAll Co., 254 N. Laurel Ave., Des Plaines, III.
Jarvis, Chas. L., Co., Middletown, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

(*Continued on page 362*)

For more information on products advertised, use Inquiry Card, page 265

fused quartz

VK OPTICAL FLATS



Accurate to .000001"

With VK Optical Flats, close checking of flat surfaces is simplified and more conveniently handled.

Shown here is the new Van Keuren monochromatic light, 22¼" wide, 17¼" high and 20" deep (in bench space). It is designed for use with large optical flats such as the one shown—a 10" diameter fused quartz double-surface master flat (accurate to .000001" both sides).

VK Optical Flats are available in sizes from ½" diameter to 10" diameter in .000001", .000002" or .000004" accuracy. They can be shipped within 30 days from order.

Catalog and Handbook No. 35 is available by writing: The Van Keuren Co., 178 Waltham St., Watertown, Mass. Ask for your copy.

VK

35th YEAR

THE Van Keuren CO.,

178 WALTHAM STREET, WATERTOWN, MASS.

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Cemented Carbide Plug Gages • Carboloy Cemented Carbide Measuring Wires Chrome Carbide Taper Insert Plug Gages

FILING MACHINES, Dies, Etc.
Boice-Crane, 941 W. Central Ave., Toledo, Ohio.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Grob, Inc., Grafton, Wis.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Jarvis, Chas. L., Co., Middletown, Conn.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILTERS, Air
Keller Tool Co., Grand Haven, Mich.

FILTERS, Coolant and Oil
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Cuno Engrg. Corp., Meriden, Conn.
Industrial Filtration Co. (Delpark Corp.) 15 Industrial Ave., Lebanon, Ind.

FINISHES FOR MACHINES AND METAL PARTS
Lowe Bros. Co., Dayton, Ohio.

FLEXIBLE COUPLINGS
See Couplings, Flexible

FLEXIBLE SHAFT EQUIPMENT
Jarvis Chas. L., Co., Middletown, Conn.
Orban, Kurt, Co., Inc. 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney West Hartford 1, Conn.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

FORGINGS, (Upsetting) Machines
Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

FORGINGS, Drop
Bethlehem Steel Co. Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORGINGS, Hollow Bored
Bethlehem Steel Co., Bethlehem, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Iron and Steel
Bethlehem Steel Co., Bethlehem, Pa.
Cameron Iron Works, Inc., 1000 Silber Rd., Houston, Texas.
Morgan Engrg. Co., Alliance, Ohio.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Wyman-Gordon, Madison & Gob Sts., Worcester 1, Mass.

FORGINGS, Upset
Bethlehem Steel Co., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORMING AND BENDING MACHINES
American Steel Foundries, Elmes Engrg. Div., Paddock Rd., and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hufford Machine Works, Inc., (Stretch-wrap), 1700 E. Grand Ave., El Segundo, Calif.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Yoder Co., 5500 Walworth, Cleveland, Ohio.

FORMING AND STAMPING MACHINES
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

FORMING TOOLS or Tool Blanks
Brown & Sharpe Mfg. Co., Providence, R. I.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FRAMES, Machinery Welded
Mahon, R. H. Co., Detroit 34, Mich.

FURNACES, Heat-Treating
General Electric Co., Schenectady 5, N. Y.

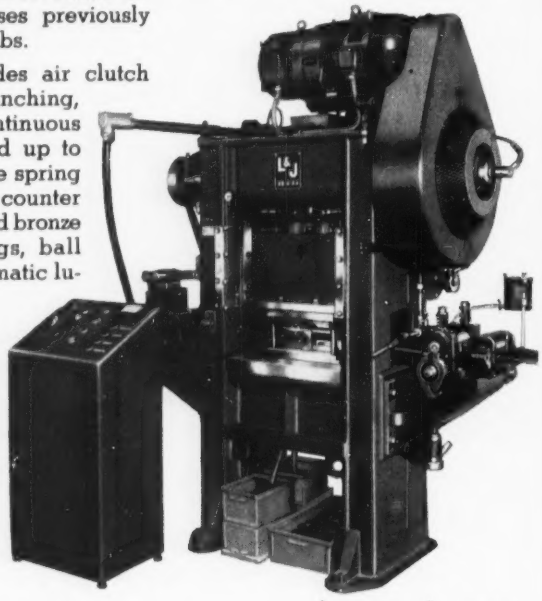
(*Continued on page 364*)

L&J DOUBLE CRANK PRESSES
for High Speed Production

These versatile double crank, straight side punch presses can multiply your production of small precision parts. Proven by users to be more efficient, accurate, economical of manpower . . . much superior to any presses previously used for the same jobs.

Equipment includes air clutch with controls for inching, single stroke and continuous running—any speed up to 450 SPM; air release spring set brake; two air counter balances on ram; hard bronze crankshaft bushings, ball seats and gibs; automatic lubrication; feeding device and other equipment to meet the most exacting requirements.

Write for complete information. Also 6 to 80 ton O. B. I. Presses.



Advantages
- Faster production
- Precision parts
- Large die area
- Long die life
- Adaptable for many jobs
- Low operating cost

Features
- High speed with accuracy
- Box type ram
- Adjustable square type hard bronze gibs
- Box type, rigid, welded steel frame
- Auxiliary equipment to suit the job

SPECIFICATIONS	Model 20-2-24	Model 30-2-24
Capacity	20 tons	30 tons
Strokes per minute	150-450	150-450
Stroke length, standard maximum to order	1" 2"	1" 2"
Ram adjustment (ratchet)	2"	2"
Ram area, L to R x F to B	24" x 12"	24" x 12"
Bolster area L to R x F to B	24" x 19"	24" x 19"
Die space, bed to ram (1" stroke down, adjust. up)	11"	11"
Weight, approx. pounds, as illustrated	6000	6500

L&J PRESS CORPORATION
1631 Sterling Avenue, Elkhart, Indiana

For more information on products advertised, use Inquiry Card, page 265

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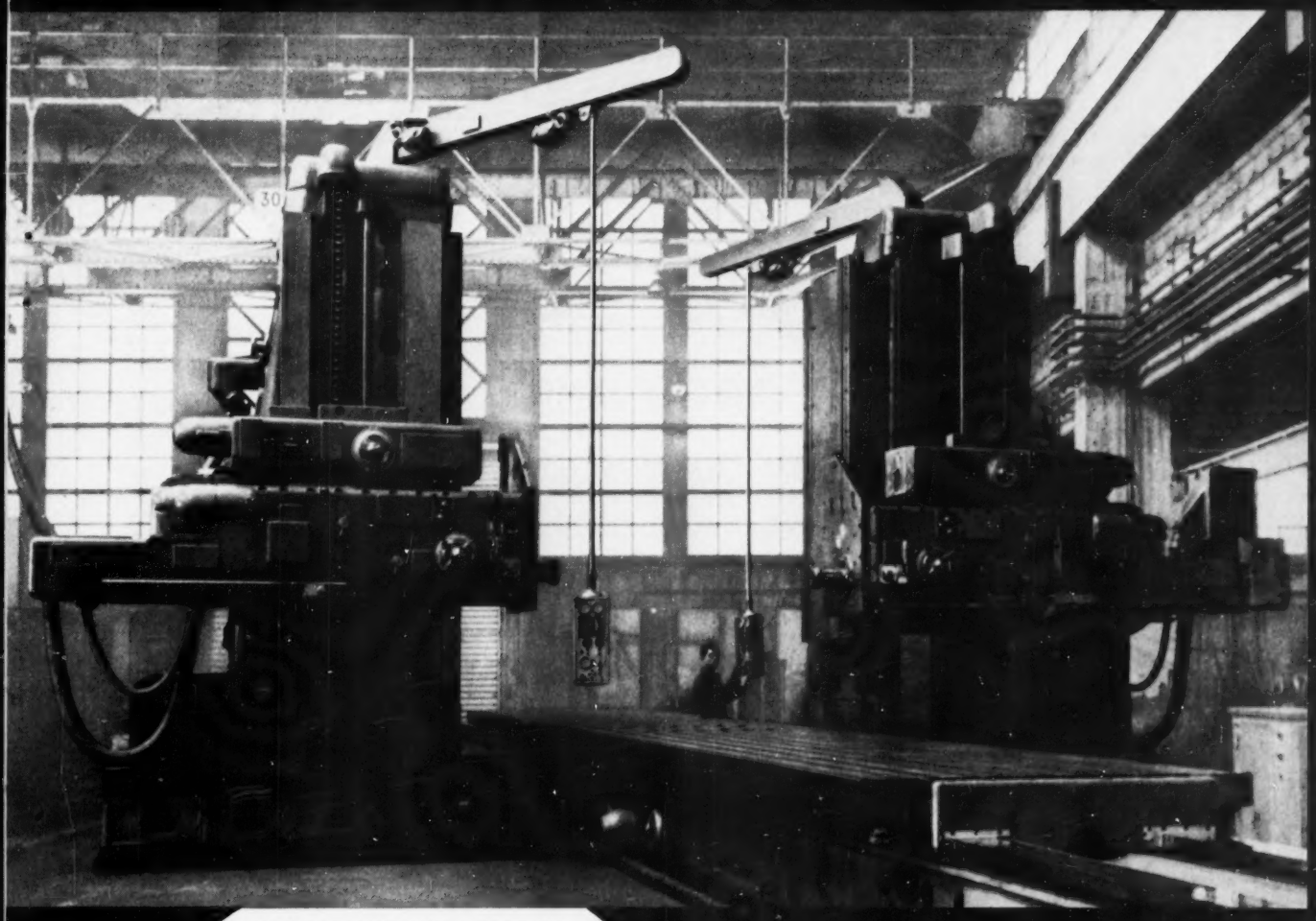
Lic. CWB



DOUBLE MILLING & BORING
MACHINE "FAP." (planer Type) 2M

Available power for cutter on each headstock:
40 HP.

Possibility of coupling the two spindles for machining turbine bodies.

Minimum overhang, maximum rigidity by approaching of columns and headstocks.

Heavy boring operations with the feed of columns; boring travel at request.

Series operations by automatic cycles; electric control.

Control from pendant box of all automatic, simultaneous or separate feed movements; spindle speed selector; slides locking.

Additional swinging arm or cross-beam can be provided with one or two milling vertical headstocks.

Spindle speeds: 1,3 to 640 rpm.

Weight: 160 tons.

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MILAN • PARIS

Information and literature from:
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FURNITURE, Shop
Standard Pressed Steel Co., Jenkintown, Pa.

GAGE BLOCKS
Brown & Sharpe Mfg. Co., Providence, R. I.
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc. 200 Lafayette St., New York 12, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

GAGES, Air
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Comparator
Alina Corp., 401 Broadway, New York 13, N.Y.
Amco Gage Co., 19760 W. 8 Mile Rd., Detroit 19, Mich.
Ames, B. C., Co., Waltham 54, Mass.
Baptist Machine Co., Inc., 36 Ludlow St., Stamford, Conn.
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Comtor Co., 47 Farwell St., Waltham 54, Mass.
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George Co., Inc., 200 Lafayette St. New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Depth
Ames, B. C., Co., (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Hanson-Whitney Co., Div., Whitney Chain Co., Hartford, Conn.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Dial
Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Scherr, George, Co. Inc. 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Gage Co., Inc., Poughkeepsie N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket R. I.

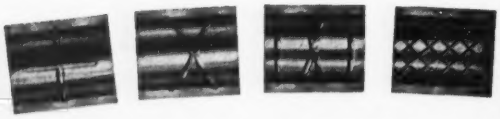
GAGES, Electric
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027 Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GAGES, Height
Amco Gage Co., 19760 W. 8 Mile Rd. Detroit 19, Mich.
Ames, B. C., Co., Waltham 54 Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp. 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol Mass.

GAGES, Plug, Ring and Snap
Amco Gage Co., 19760 W. 8 Mile Rd., Detroit 19, Mich.
Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Co., Div., Whitney Chain Co., Hartford, Conn.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp. 721 Springfield, Dayton, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co. Athol Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Turner Bros. Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Vinco Corp., 9113 Schaefer Hwy., Detroit 28, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.
Woodworth, N. A. Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

(*Continued on page 366*)

High Speed
CONTINUOUS OIL GROOVING

500

PIECES PER HOUR!

High-production and economical operation are the features of the WICACO CONTINUOUS OIL GROOVER . . . capable of completing as many as 500 grooved pieces per hour in routine practice—even with unskilled labor!

The operator loads and unloads the work **without stopping the Machine**—a valuable time-saving advantage made possible by the WICACO upright construction of the spindle and stationary chuck. Feed-lever automatically returns to neutral position when cutting tool reaches its proper depth. The spindle—not the chuck—revolves, permitting fast and convenient grooving of a variety of larger and irregular work. Maximum depth of groove 7/32", maximum width 3/8", grooves may be cut in work from 1/4" I.D. to 4 1/2" I.D.; standard chuck holds work to 4½" O.D.; stroke of spindle from 0" to 7"; floor space 24" dia.; weight of machine about 950 lbs.

Send us sample bearings to cut to specifications. We will return them, properly grooved, with a record of the time required and a cost-estimate. No obligation. Or, write for detailed, well-illustrated Bulletin.

WICACO

SINCE 1868

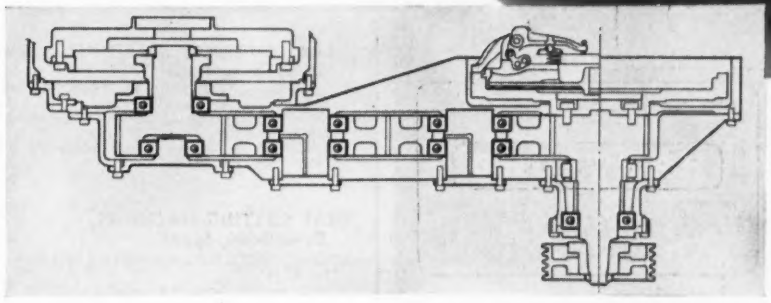
THE WICACO MACHINE CORPORATION

WAYNE JUNCTION PHILADELPHIA 44, PA.

For more information on products advertised, use Inquiry Card, page 265

NEW DEPARTURES at work in Dart's new monster

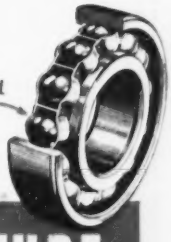
This dual-engine giant has two torque converters, two transfer cases and two reverse gear boxes in which New Departure applications are found. Cross section of transfer case shows seven **ball** bearings—all New Departures!



Weight—50 tons! Payload—75 tons! It's Dart's mighty Monster, world's biggest truck; yet it's agile, too. Here's where New Departure **ball** bearings carry the loads . . . in the transfer cases, reversing gears and torque converters that deliver a 700-horsepower drive to tandem rear axles.

Whatever the load . . . radial, thrust or any combination . . . New Departure **ball** bearings mean precision performance. They maintain accurate positioning of gears and shafts . . . reduce wear and maintenance to the minimum.

Learn what *ball* bearings can do for *your* product . . . talk to your New Departure engineer—soon!



NEW DEPARTURE
BALL BEARINGS

NEW DEPARTURE • DIVISION OF GENERAL MOTORS • BRISTOL, CONNECTICUT
Plants also in Meriden, Connecticut, and Sandusky, Ohio
In Canada: McKinnon Industries, Ltd., St. Catharines, Ontario

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			DAVENPORT	2212 E. 12th St.	Davenport 7-7522			

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Amco Gage Co., 19760 W. 8 Mile Rd., Detroit 19, Mich.
Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol Mass.

GAGES, Taper

Brown & Sharpe Mfg. Co., Providence, R. I.
Dearborn Gage Co. 22038 Beech St., Dearborn, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Thread

Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Iroquois Corp., RFD 4 Box 331, 1800 E. 11 Mile Rd., Royal Oak, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
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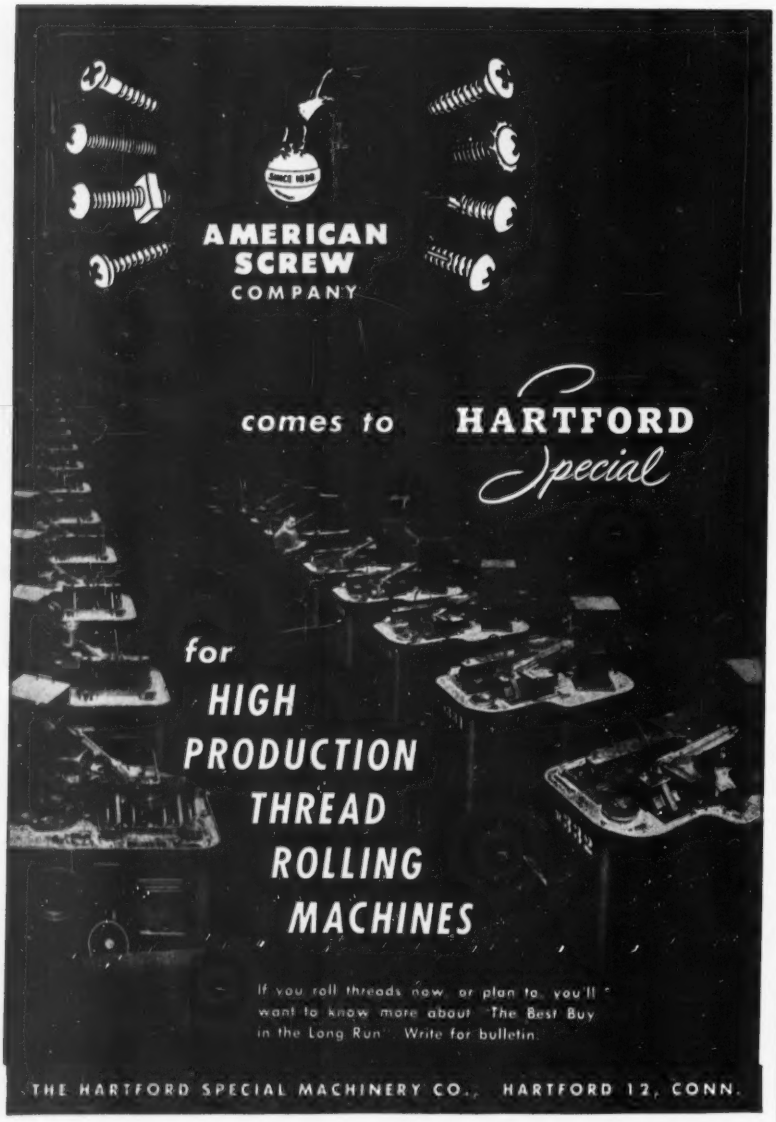
Woodworth, N. A. Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

GASKETS

Crane Packing Co., 1800 Cuyler Ave., Chicago.
Garlock Packing Co., Palmyra, N. Y.



GEAR BLANKS, Non-Metallic

Braun Gear Co., 239 Richmond, Brooklyn 8, N. Y.
General Electric Co., Schenectady 5, N. Y.

GEAR BURNISHING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

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Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Orban Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GEAR CHECKING INSTRUMENTS AND EQUIPMENT

Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S. Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vinco Corp., 9113 Schaefer Highway, Detroit 28, Mich.

GEAR CUTTING MACHINES, Bevel Gears (Generators)

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Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES Bevel Gears, Spiral

Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Spur and Bevel Gears (Rotary Cutter)

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Waltham Machine Works, Newton St., Waltham, Mass.

GEAR CUTTING MACHINES, SPUR and Helical Gears (Hobbing)

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Orban Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES, Spur and Helical Gears (Shaper or Planer Type)

Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.

(*Continued on page 368*)

NEW *Grip-Tip* CENTERS

CHECK THESE *Grip-Tip* FEATURES

- Long-Life Holders
- Replaceable Carbide Tips
- Easy Insertion and Removal of Male or Female Tips
- Reduced Machine Down-Time
- Lower Cost for Replacement of Carbide Tips
- Carbide Tips Accurate to .0005"
- No Regrinding of Holder
- Carbide Tips Are Easy and Inexpensive to Stock
- Reduced Regrinding Time
- Longer Diamond Wheel Life

with

REPLACEABLE CARBIDE TIPS

Grip-Tip Centers are specifically designed to substantially reduce your replacement costs and machine down-time for regrinding or replacement of worn or chipped centers.

Male or female carbide tips are inserted or removed from the tool steel holders by simply turning a screw. The unique clamping action of holders on tips is positive and quick . . . you save replacement time with Grip-Tip Centers.

The life of Grip-Tip holders is practically unlimited, for, only the dull or chipped carbide tips are reground. Because the steel holder is not ground when sharpening the carbide tip there is less clogging and longer life for your diamond wheels. Also, the relatively inexpensive double end tips in both male and female types can be stocked with a minimum investment . . . Grip-Tip Centers reduce tool and inventory costs.

Grip-Tip Centers increase your production by permitting full utilization of machine tools. It takes but a minute to remove old carbide tip and replace with a new one . . . machine down-time is less with Grip-Tip Centers.

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DETROIT REAMER & TOOL CO.

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Fellows Gear Shaper Co., 78 River St., Springfield, Vt. (Straight and Hourglass Types).
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

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Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR GRINDING MACHINES

Cosa Corp. 405 Lexington Ave., New York 17.
Gear Grinding Machine Co., 3901 Christopher St., Detroit 11, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Van Norman Co., Springfield, Mass.

GEAR HARDENING MACHINES

Gleason Works, 1000 University Ave., Rochester 3, N. Y.

GEAR LAPPING MACHINES

Fellows Gear Shaper Co., 78 Rover St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEAR MOTORS

See Speed Reducers.

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Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

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Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEARS, CUT

Amgears, Inc., 6633 W. 65th St., Chicago 38, Ill.
Automotive Gear Works, Inc., Richmond, Ind.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Brad Foote Gear Works, 1309 S. Cicero Ave., Cicero 50, Ill.
Braun Gear Co., 239 Richmond, Brooklyn 8, N. Y.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gears Div., Michigan Tool Co., 7200 E. McNichols Rd., Detroit, Mich.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Franke Gear Works, Inc., 1924 W. Columbia Ave., Chicago 26, Ill.
Gear Specialties Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Illinois Gear & Mch. Co., 2120 No. Natchez Ave., Chicago 35, Ill.
Mass. Gear & Tool Co., 36 Nassau St., Woburn, Mass.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 13, Mich.
New Jersey Gear Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Ohio Gear Co., 1333 E. 179th St., Cleveland.
Perkins Machine & Gear Co., West Springfield, Mass.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Pittsburgh Gear Co., Neville Island, Pittsburgh 25, Pa.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Williamson Gear & Machine Co., 2606 Martha St., Philadelphia 25, Pa.

GEARS, Rawhide and Non-Metallic

Amgears, Inc., 6633 W. 65th St., Chicago 38, Ill.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Braun Gear Co., 239 Richmond, Brooklyn 8, N. Y.

(*Continued on page* 370)

GREAVES MILLS

performance and features equal to or surpassing machines costing up to 58% more!

MAKE YOUR OWN COMPARISON with a free chart comparing these 22 specifications on 6 leading mills!

- Price
- Working Surface
- T-Slots—number and width
- T-Slots—center distance
- Swivels
- Longitudinal Power Feed
- Cross Power Feed
- Vertical Power Feed
- Spindle Center Line to Top of Table—Max.
- Spindle Center Line to Top of Table—Min.
- Column to Brace
- Column to Inside Arbor Support
- Arbor to Underside of Overarm
- Taper Hole • Nose Diameter
- Hole Through Spindle
- Speeds • Speed Range
- Feeds • Feed Range
- Power • Weight

Ask about our tool lease and deferred payment plans.

Features and dimensions are easy to compare . . . and so is performance, backed up by user reports stating that Greaves 2H plain and universal milling machines outperform mills costing almost twice as much!

Before you buy any milling machine, send for your copy of the Greaves Comparison Chart. You'll find that the Greaves is full size, completely rugged, accurate and dependable . . . yet it sells for thousands of dollars less than comparable machines.

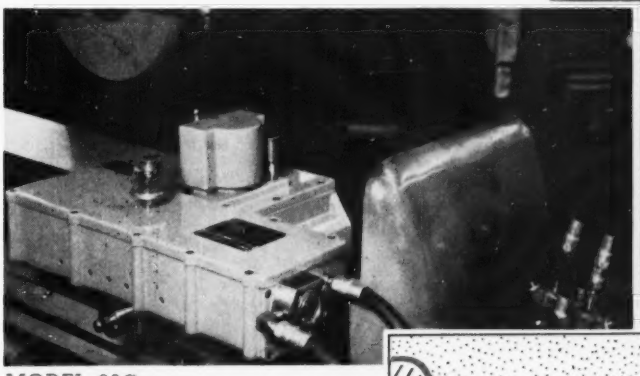
Write for your copy of this eye-opening comparison chart

GREAVES MACHINE TOOL CO.
2500 Eastern Avenue, Cincinnati 2, Ohio
Please send me: ☐ the COMPARISON CHART ☐ Tool Lease and Deferred Payment Plans
Name _____ Title _____
Firm _____
Address _____
City _____ Zone _____ State _____

For more information on products advertised, use Inquiry Card, page 265

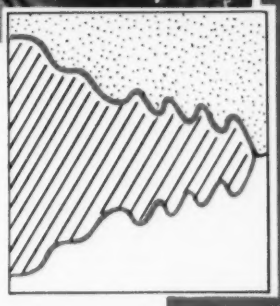
fast, accurate, automatic contour wheel dressing . . .

is now possible with any one of the complete line of Hoglund contour grinding wheel dressers. Almost any desired contour that can be entered by a diamond can be dressed into the wheel with the accuracy of tenths. All Hoglund dressers feature an uninterrupted cut across the wheel, producing a perfect blend of all radii and tangents, so important for the elimination of stress concentration at the root fillet in gears and splines.



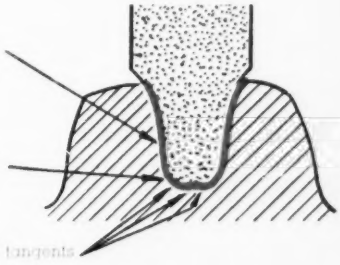
MODEL 32C
MOUNTED ON THOMPSON 2F GRINDER

The Model 32 requires little skill to set up and operate. It is actuated and controlled hydraulically to automatically dress any complex contour into the grinding wheel. The difficult "Christmas tree" form, used for grinding turbine buckets, is easily produced by the Hoglund #32 dresser.



Enlarged template control permits extreme accuracy . . . reduction ratios as high as 20:1 are possible.

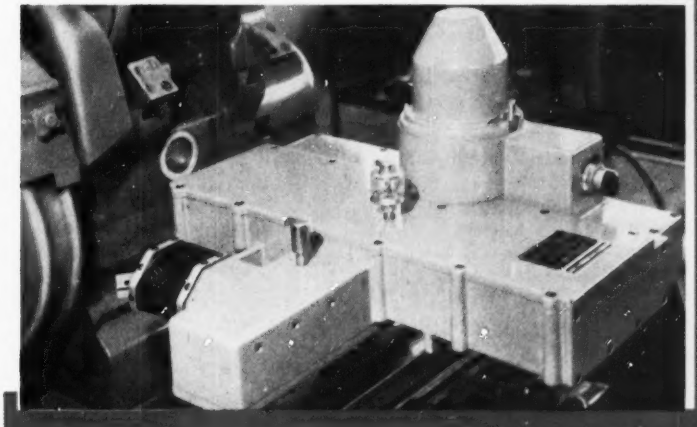
Pantograph linkages are completely eliminated...Instead, sure, accurate reduction from contour template is made by means of inclined planes.


One continuous automatic dressing for involute sides, root fillets and bottom land
Produces perfect blend between involute and root fillet
Smooth flow-in of all curves and tangents eliminating stress concentrations

HOGLUND MICROSCOPE FIXTURE CUTS SET-UP TIME BY PRESETTING DIAMONDS IN HOLDERS

To easily and precisely set the diamonds in their holders, a 40X microscope fixture is used. Diamonds can be set in advance at any convenient time with complete assurance of extreme accuracy that only optical setting can provide. Settings as close as .0001" can be made with little skill. Use of the HOGLUND MICROSCOPE fixture is an important aid to precision.

MODEL 42 ELECTRICAL AUTOMATIC DRESSER FOR CYLINDRICAL GRINDERS



MORE THAN 70 STANDARD MODELS AVAILABLE

Whatever your contour dressing problem, you are sure to find a Hoglund dresser to fit your needs. In addition to the more than 70 standard models available, the Hoglund engineering staff is always ready to provide adaptations, modifications, or a complete new design to suit your particular needs.

Send us your blueprints and specifications...we will be pleased to submit our recommendations.

HOGLUND Engineering & Manufacturing Co., Inc.
343 SNYDER AVENUE, BERKELEY HEIGHTS, NEW JERSEY

Cincinnati Gear Co., Wooster Pike and Marie-mont Ave., Cincinnati, Ohio.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Gear Specialties Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Ohio Gear Co., 1333 E. 179th St., Cleveland.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Pittsburgh Gear Co., Neville Island, Pittsburgh 25, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.
Williamson Gear & Machine Co., 2606 Martha St., Philadelphia 25, Pa.

GENERATORS, Electric

General Electric Co., Schenectady 5, N. Y.
Lincoln Electric Co. (Arc), 22801 St. Clair Ave., Cleveland, Ohio.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.

GRADUATING MACHINES

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.

GREASE

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 129 Lockwood St., Newark 5, N. J.
Sinclair Refining Co., 600 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia.
Texas Co., 135 E. 42nd St., New York, N. Y.

GRINDERS, Carbide Tool

See Grinding Mches, Carbide Tool

GRINDERS, Centerless

Van Norman Co., Springfield, Mass.

GRINDERS, Die and Mold

Consolidated Mch. Tool Corp., Rochester, N. Y.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

GRINDERS, Oilstone, for Woodworking Tools

Mummert-Dixon Co., Hanover, Pa.

GRINDERS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Conn.
Madison-Kipp Corp., Madison, Wis.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

GRINDERS, Portable Electric and Toolpost

Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Millers Falls Co., Greenfield, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

GRINDING FIXTURES

Amco Gage Co., 19760 W. 8 Mile Rd., Detroit 19, Mich.
Geometric Tool Co. (Die Chaser), Westville Station, New Haven 15, Conn.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GRINDING MACHINES, Abrasive Belt

Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Mch. Works, Rockford, Ill.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

GRINDING MACHINES, Bench

Besley-Welles Corp., Beloit, Wis.
Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Millers Falls Co., Greenfield, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Walker-Turner Div. Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

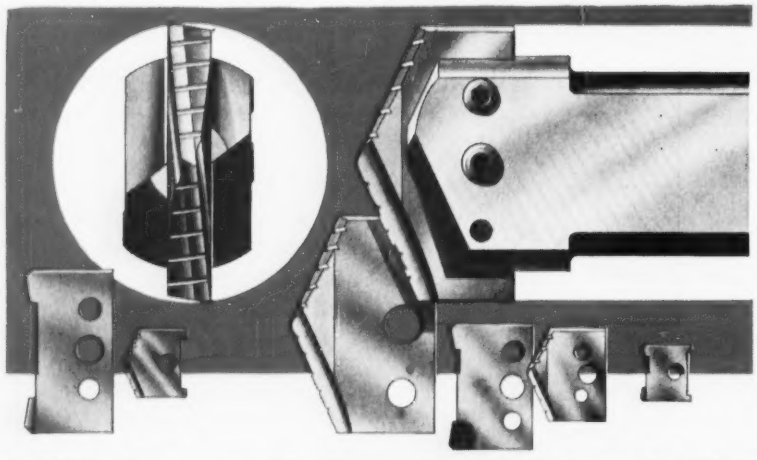
GRINDING MACHINES, Broach

Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Lapointe Mch. Tool Co., 34 Tower St., Hudson, Mass.

GRINDING MACHINES, Camshaft

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

(*Continued on page 374*)



Drill Large Holes from the Solid with Interchangeable Spade Drills

Made in 256 cutter sizes, 1 to 5 inch diameter, in steps of 1/64, Conner type Spade Drills drill the required diameter in one operation, need no retracting to clear them of chips. Only eight sizes of holders are needed to handle all cutter sizes.

For general purpose work and in the Tool Room, use the cutter and holder assembly shown above. It is a rugged tool of great rigidity, recommended for large holes of medium depth.

For Production Drilling (for repetitive work), and for the somewhat deeper holes, use Conner type Oil Hole Holders designed for easy coolant flow and fast chip expulsion.

Send for Catalog and Price List

For Boring: Core Drill Cutters, for semi-finishing of cored and drilled holes, are made in the same 256 sizes, to fit the same spade drill holders.

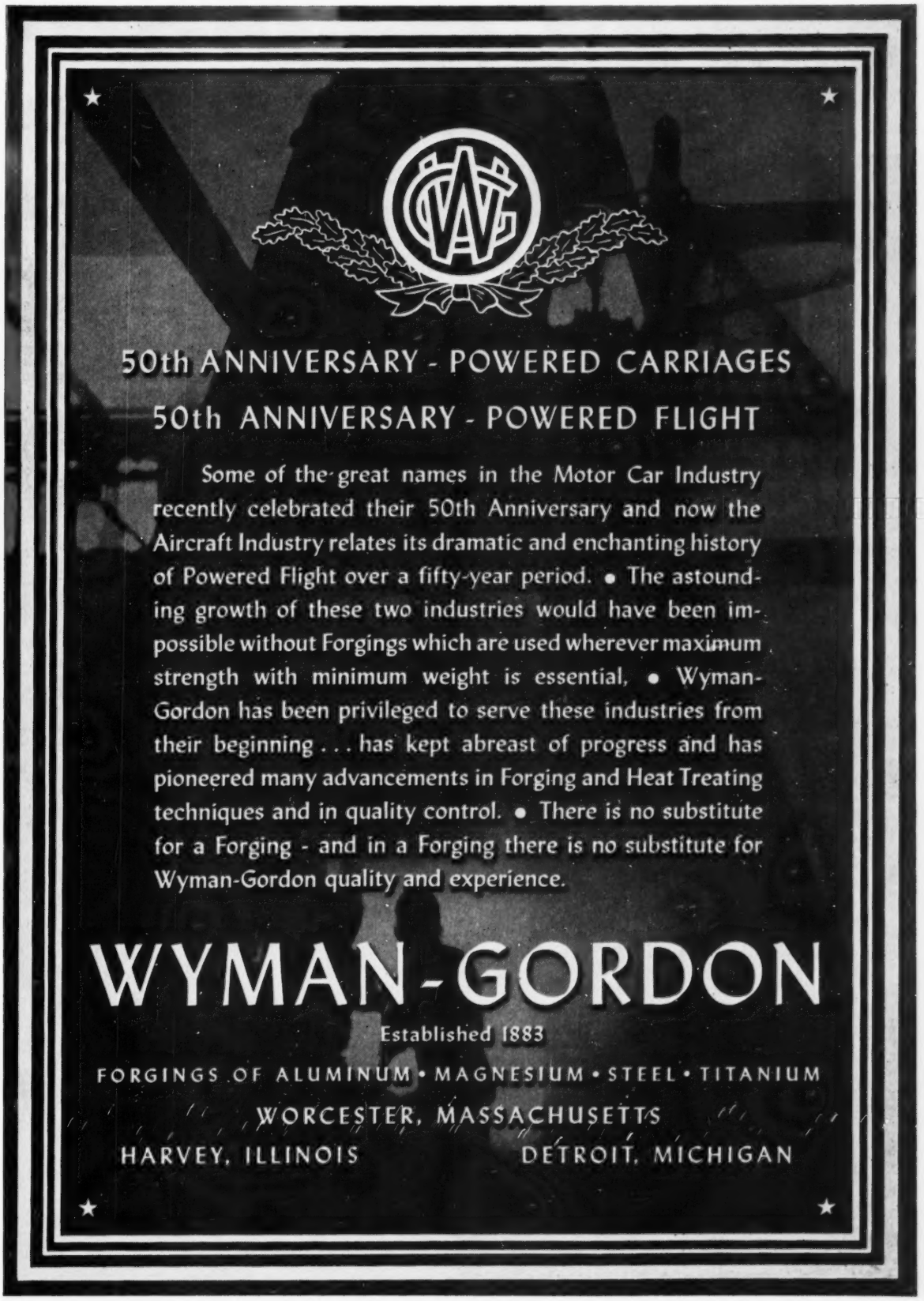
The Gairing Tool Company is now the exclusive manufacturer of the Spade and Core Drills, both standard and special, formerly made by the Conner Tool & Cutter Company.

In Canada: A. C. Wickman (Canada) Ltd., Queensway, Toronto 14

The GAIRING Tool Company

21225 Hoover Road **Detroit 32, Mich.**

For more information on products advertised, use Inquiry Card, page 265


50th ANNIVERSARY - POWERED CARRIAGES
50th ANNIVERSARY - POWERED FLIGHT
Some of the great names in the Motor Car Industry recently celebrated their 50th Anniversary and now the Aircraft Industry relates its dramatic and enchanting history of Powered Flight over a fifty-year period. • The astounding growth of these two industries would have been impossible without Forgings which are used wherever maximum strength with minimum weight is essential. • Wyman-Gordon has been privileged to serve these industries from their beginning . . . has kept abreast of progress and has pioneered many advancements in Forging and Heat Treating techniques and in quality control. • There is no substitute for a Forging - and in a Forging there is no substitute for Wyman-Gordon quality and experience.
WYMAN-GORDON
Established 1883
FORGINGS OF ALUMINUM • MAGNESIUM • STEEL • TITANIUM
WORCESTER, MASSACHUSETTS
HARVEY, ILLINOIS
DETROIT, MICHIGAN

SCULLY JONES

"Precision

give you benefits

Quick-Change Chucks speed sequence operations on radial drill at "Caterpillar"

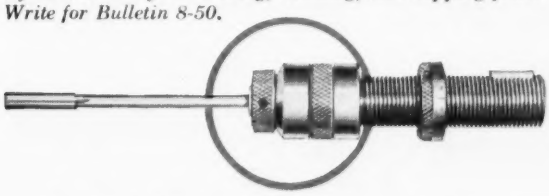
This radial drill at Caterpillar Tractor Co. does sequence operations with multiple-spindle efficiency because Scully-Jones Quick-Change Chucks make tool changes easy and fast! Just lift the locking ring without stopping the machine for quick, safe tool changes. Use them to speed production and reduce operator fatigue on your single-spindle sequence drilling, reaming, tapping, and other jobs. *Write for Bulletin 3-50.*

Holding" Tools

which reduce costs on every job!

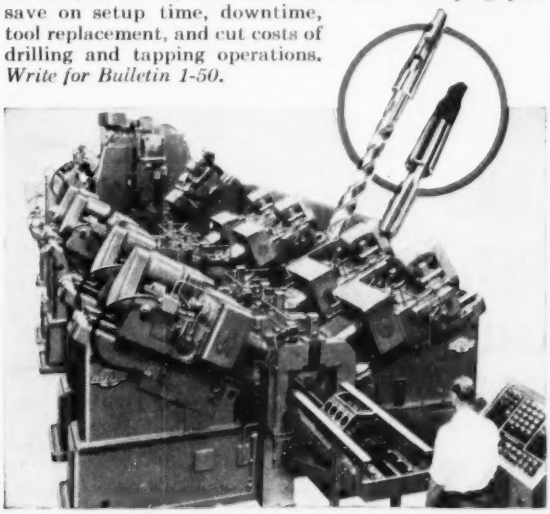
Newest Floating Holder simplifies tool changes, assures free float

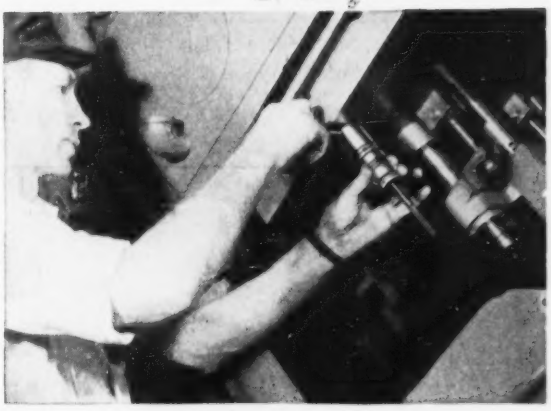
Here's how Greenlee Bros. & Co. uses the Scully-Jones new "JT" Lock and Eject Collet Type Floating Holder on multiple-spindle transfer units. With the double-gear spline drive principle, these floating holders compensate for any misalignment between tools and work . . . easily maintain close tolerances . . . reduce downtime and damage to cutting tools . . . speed and simplify tool changes . . . reduce maintenance troubles and costs. With true freedom of float, they eliminate "dead spots" and cramping—conditions that may be affecting tool life and quality of work on *your* drilling, reaming, and tapping jobs! *Write for Bulletin 8-50.*



Drill and Tap Chucks cut production costs on Greenlee transfer unit

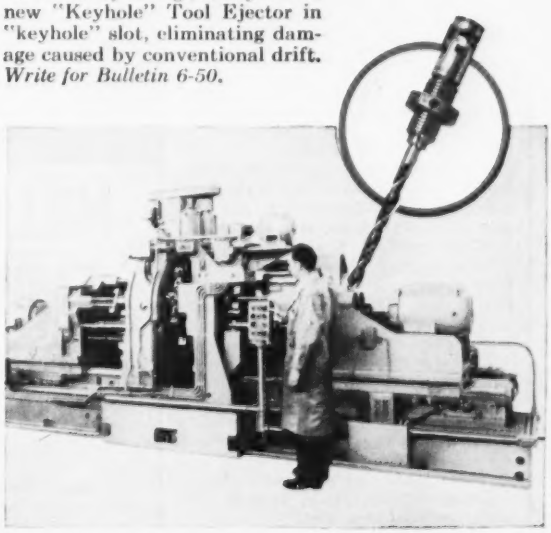
Greenlee engineers put Scully-Jones Drill and Tap Chucks on this 16-station transfer unit to provide a positive, accurate drive for the cutting tools. Carefully hardened and ground, they resist nicking, give long life under heavy stresses, or loads, and run concentric . . . helping you save on setup time, downtime, tool replacement, and cut costs of drilling and tapping operations. *Write for Bulletin 1-50.*





Adjustable Adapters speed tool changes and adjustments

Scully-Jones Quick-Lock Adjustable Adapters help this BARNESDRILL 10-station double end trunnion machine operate at near capacity. The "pilot nose" makes it easy to insert the adapters . . . minimizing setup and downtime for tool changes. Quick-Lock Nut provides quick, accurate depth adjustments at each spindle or in a tool presetting program. Cutting tools are quickly removed by using Scully-Jones new "Keyhole" Tool Ejector in "keyhole" slot, eliminating damage caused by conventional drift. *Write for Bulletin 6-50.*



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SCULLY-JONES

"Precision Holding" for holding precision

Call your Scully-Jones representative or distributor—factory-trained "Precision Tool and Work Holding Specialist"—for complete information and service.

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Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

GRINDING MACHINES, Centerless

Cincinnati Grinders, Inc., Cincinnati, Ohio.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Chucking

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Bullard Co., Brewster St., Bridgeport, Conn.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Crankshaft

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Cylindrical

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Landis Tool Co., Inc., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Van Norman Co., 2640 Main St., Springfield 7, Mass.

GRINDER MACHINES, Die Chaser

Eastern Mch. Screw Corp., New Haven, Conn.
Landis Machine Co., Waynesboro, Pa.

GRINDING MACHINES, Disc

Besley-Welles Corp., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Mattison Machine Works, Rockford, Ill.

GRINDING MACHINES, Drill

Blake, Edward Co., 442 Cherry St., West Newton 65, Mass.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Gailmeyer & Livingston Co., 336 Straight Ave., S. W. Grand Rapids 4, Mich.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Union Twist Drill Co., Athol, Mass.

GRINDING MACHINES, Face

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Besley-Welles Corp., Beloit, Wis.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Mattison Machine Works, Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

GRINDING MACHINES, Flexible Shaft

See Flexible Shaft Equipment

GRINDING MACHINES, Gap

Cincinnati Grinders, Inc., Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.

GRINDING MACHINES, Gear Tooth

See Gear Grinding Machines

GRINDING MACHINES For Sharpening Cutters, Reamers, Hobs, Etc.

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gailmeyer & Livingston Co., 336 Straight Ave., S. W. Grand Rapids 4, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Landis Tool Co., Waynesboro, Pa.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

(*Continued on page 376*)

MULTIPLY PROFITS BY MULTIPLE OPERATIONS

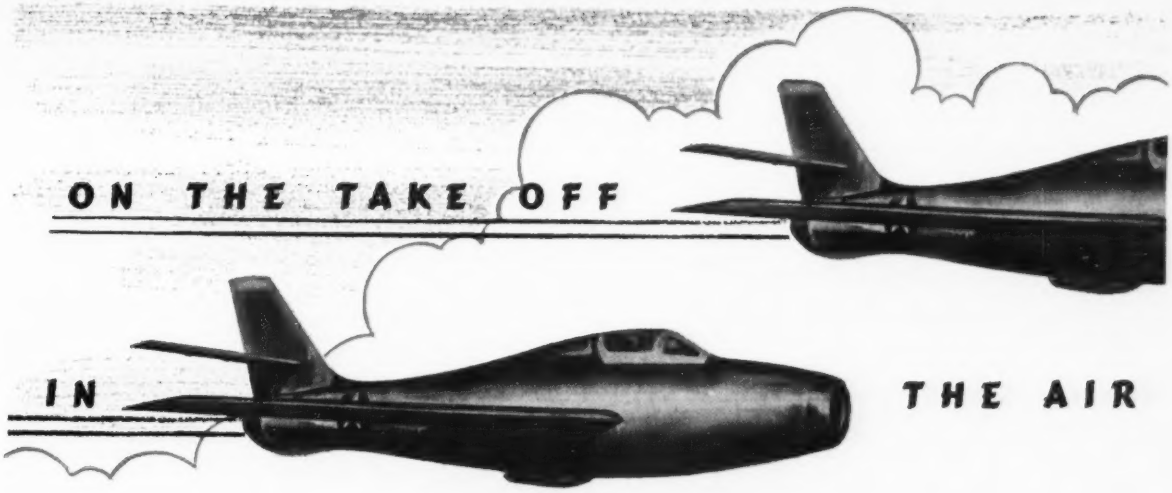
Part:
Steering gear housing. (Two different parts run on same machine with tool change only.)
Material: Malleable iron.
Operation: *Station 1*—Load and unload. *Station 2*—Drill (3) .368" holes; (1) .120" hole. *Station 3*—Combination spot face and chamfer (3) holes, drill (1) 23/32" hole for tapping. *Station 4*—Tap (3) 7/16"-14 NC-3 thread; tap 1/2"-14 NPSF thread.
Description: Millholland 4-station automatic index machine equipped with 4-station automatic index table, with 1 No. 5 Millholland Automatic Unit driven by 7-1/2 HP motor with 8-spindle ball bearing multiple head for drilling 5 holes and combination spot facing and chamfering 3 holes; 4-spindle tapper on right-hand column.
Operator loads part and pushes button initiating automatic cycle, unloads. Two parts machined at a time.

MILLHOLLAND ENGINEERED FOR MAXIMUM PRODUCTION

For special production machines, Millholland Automatic Units offer distinct advantages. These self-contained units, driven by individual motors, are readily adapted to a wide range of operations. Their full automatic cycle with interlocked controls permits several units to be grouped for simultaneous operations, or they can be mounted on other production machines and synchronized to perform additional operations. Millholland Automatic Units have proved themselves in 30 years of outstanding performance on all types of jobs. Get full details in Bulletin M-7.

W. K. MILLHOLLAND MACHINERY CO.
6402 Westfield Blvd., Indianapolis 2, Indiana

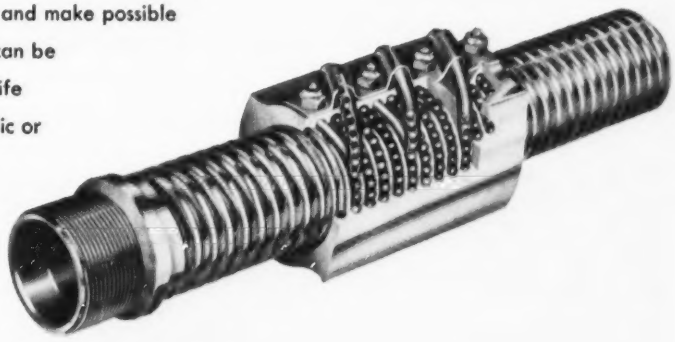
For more information on products advertised, use Inquiry Card, page 265



OR MAKING AN APPROACH

IT'S CONTROL THAT COUNTS

With modern aircraft traveling at higher speeds and altitudes than ever before, the need for sure, sensitive controls has also increased. That's why so many military and commercial aircraft are equipped with Saginaw Ball Bearing Screws. These thoroughly reliable screw mechanisms transmit the rotary-to-linear force through rolling steel balls with less than 10% friction loss. They are compact and low in weight-strength ratio. In the actuators of ailerons, wing flaps, trim tabs, tail surface controls and many other vital aircraft parts, they give efficient and dependable service and make possible important weight savings. Saginaw Screws can be supplied in a complete range of load and life requirements for use with electrical, hydraulic or pneumatic units. Write today for our free engineering data book.



Saginaw STEERING GEAR DIVISION

72

GENERAL MOTORS CORPORATION • SAGINAW, MICHIGAN • MANUFACTURERS OF SAFETY POWER STEERING

For more information on products advertised, use Inquiry Card, page 265

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Pratt & Whitney, West Hartford 1, Conn.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.
Union Twist Drill Co., Athol, Mass.

GRINDING MACHINES, For Sharpening Turning and Planing Tools

Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
South Bend Lathe Works Inc., 425 E. Madison St., South Bend, Ind.
Walker, O. S., Co., Inc., Worcester Mass.
Waltham Machine Works, Newton St., Waltham, Mass.

GRINDING MACHINES, Internal

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Bryant Chucking Grinder Co., 257 Clinton St., Springfield, Vt.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit, 32, Mich.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.
Wicaco Machine Corp., Stenton Ave. and Louden St., Philadelphia, Pa.

GRINDING MACHINES, Jig

Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Pratt & Whitney, West Hartford 1, Conn.

GRINDING MACHINES, Knife and Shear Blade

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Machine Works, Rockford, Ill.
United States Electrical Tool Div., Emerson Elec. Mfg. Co., 1050 Findlay St., Cincinnati 14, Ohio.

GRINDING MACHINES, Piston Ring

Besly-Welles Corp., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Profile

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cleveland Grinding Machine Co., 1643 Eddy Rd., Cleveland 12, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GRINDING MACHINES, Ring Wheel Ball Race, Etc.

Besley-Welles Corp., Beloit, Wis.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Landis Tool Co., Waynesboro, Pa.
Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Radial

Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

GRINDING MACHINES, Radius, Link

Besly-Welles Corp., Beloit, Wis.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Roll

Farrel-Birmingham Co., 25 Main St., Ansonia Conn.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Spline Shaft

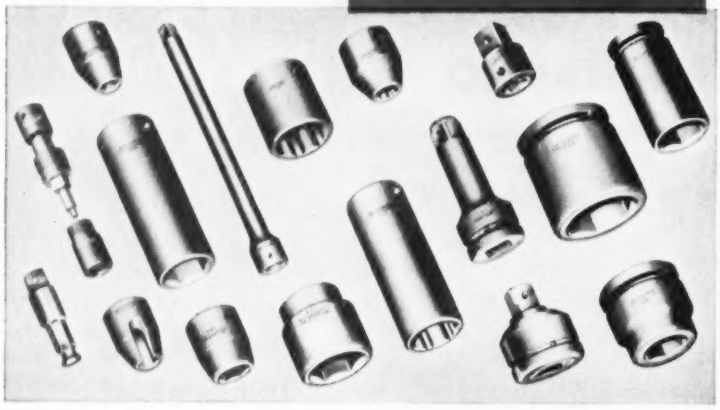
Van Norman Co., Springfield, Mass.

GRINDING MACHINES, Surface

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass. (Rotary)
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Besly-Welles Corp., Beloit, Wis.
Blanchard Machine Co., 64 State St., Cambridge, Mass.

(*Continued on page* 378)

Get the MOST from your power wrenches, use WILLIAMS INDUSTRIAL SOCKETS



● Team Williams Industrial Sockets with any type of power or impact wrench for single or multiple nut running . . . production or maintenance work. They deliver as much as 20% more on-the-job service . . . extend life of both wrench and tong.

NEW ADDITIONS to the wide range of sizes and styles in seven drive sizes assure a "tailor-made" combination for every application. Correct design accurately made from extra-tough, fully heat-treated alloy steel.

See them at your Distributor or write for Catalog 302.

WILLIAMS
INDUSTRIAL TOOLS
"The Broadest Line of Its Kind"

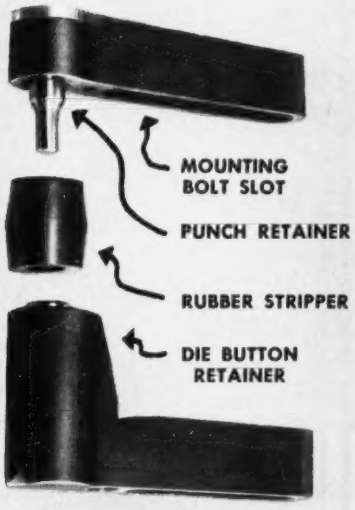
PLUS Local Service from a Williams distributor

J. H. WILLIAMS & CO. 407 Vulcan Street Buffalo 7, N. Y.

For more information on products advertised, use Inquiry Card, page 265

New

PUNCH & DIE BUTTON POSITIONING *Flexibility* with R-B *Flex-Mount* RETAINERS

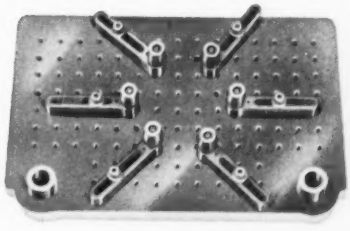


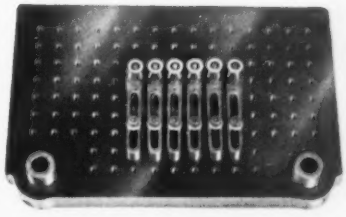
Cut your set-up time for short production runs on light gauge metals . . . R-B Flex-Mount Retainers permit quick, easy and flexible mounting of punches and die buttons. For, Flex-Mount Retainers are easily bolted in any desired position on T slotted or drilled and tapped commercial die sets.

Standardized R-B punches and die buttons (round, square, oblong or special shapes to customer specifications) are used in these retainers. Stripping is accomplished with R-B rubber strippers or R-B rubber covered springs to eliminate costly metal strippers, retainer screws and springs.

TYPICAL *Flex-Mount* POSITIONING *Flexibility*

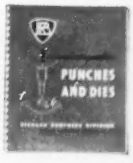
Shown are but two of an almost unlimited number of mounting arrangements that can be made with Flex-Mount Retainers.





Use R-B Engineering Service for Your Tough Piercing Problems

RICHARD BROTHERS PUNCH DIVISION
ALLIED PRODUCTS CORPORATION
DEPT. 78 • 12619 BURT RD. • DETROIT 23, MICHIGAN



Please send me additional information.

NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

Also Produced in
OTHER ALLIED PLANTS
SPECIAL COLD FORGED PARTS
STANDARD CAP SCREWS
PRECISION GROUND PARTS
SHEET METAL DIES MADE OF FERROUS ALLOYS, ZINC ALLOYS OR PLASTICS

For more information on products advertised, use Inquiry Card, page 263

Brown & Sharpe Mfg. Co., Providence, R. I.
Columbia Div., Lodge & Shipley Co., Hamilton 1, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Gollmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Mattison Machine Works, Rockford, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Reid Bros. Co., Inc., Beverly, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio.
Walker, O. S., Co., Inc., Worcester Mass.

GRINDING MACHINES, Tap

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

GRINDING MACHINES, Thread

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Landis Machine Co. (Centerless), Waynesboro, Pa.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GRINDING MACHINES, Universal

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Grinders, Inc., Cincinnati, Ohio.
Frauenthal Div., Kaydon Engineering Corp., Muskegon, Mich.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

GRINDING MACHINES, Worm

Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Pratt & Whitney, West Hartford 1, Conn.

GRINDING WHEELS

Allison Co., Bridgeport, Conn.
Besly-Welles Corp., Beloit, Wis.
Blanchard Machine Co., 64 State St., Cambridge, Mass.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Cincinnati Milling Products Div., Cincinnati Milling Machine Co., Cincinnati, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gardner Machine Co. (Surface Grinder), 414 E. Gardner St., Beloit, Wis.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.
Smit, J. K. & Sons, Inc., Murray Hill, N. J.

GROOVE PINS

Gillen, John, Co. Inc., 2540 S. 50th Ave. Cicero 50, Ill.

GROOVING TOOLS, Internal

Waldes Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

HAMMERS, Drop

Bliss, E. W. Co., 1375 Raff Rd., S. W. Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Morgan Engrg. Co., Alliance, Ohio.

HAMMERS, Forging Air

Chambersburg Engrg. Co., Chambersburg, Pa.
Lobdell United Co., 200 "G" St., Wilmington 99, Del.

HAMMERS, Pneumatic

Chambersburg Engrg. Co., Chambersburg, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.

HAMMERS, Portable Electric

Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Millers Falls Co., Greenfield, Mass.

HAMMERS, Power

Chambersburg Engrg. Co., Chambersburg, Pa.
Lobdell United Co., 2000 "G" St., Wilmington 99, Del.

HAMMERS, Shaft

S K F Industries, Inc., P. O. Box 6731, North Philadelphia, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.

HAMMERS, Soft

Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

(*Continued on page 380*)

WOODWORTH

Serves THE AIRCRAFT INDUSTRY WITH PRECISION PARTS FOR

Jet & Reciprocating Engines
Fuel Control Systems
Landing Gears

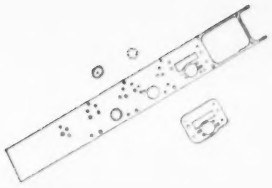
•

Accuracy you can trust

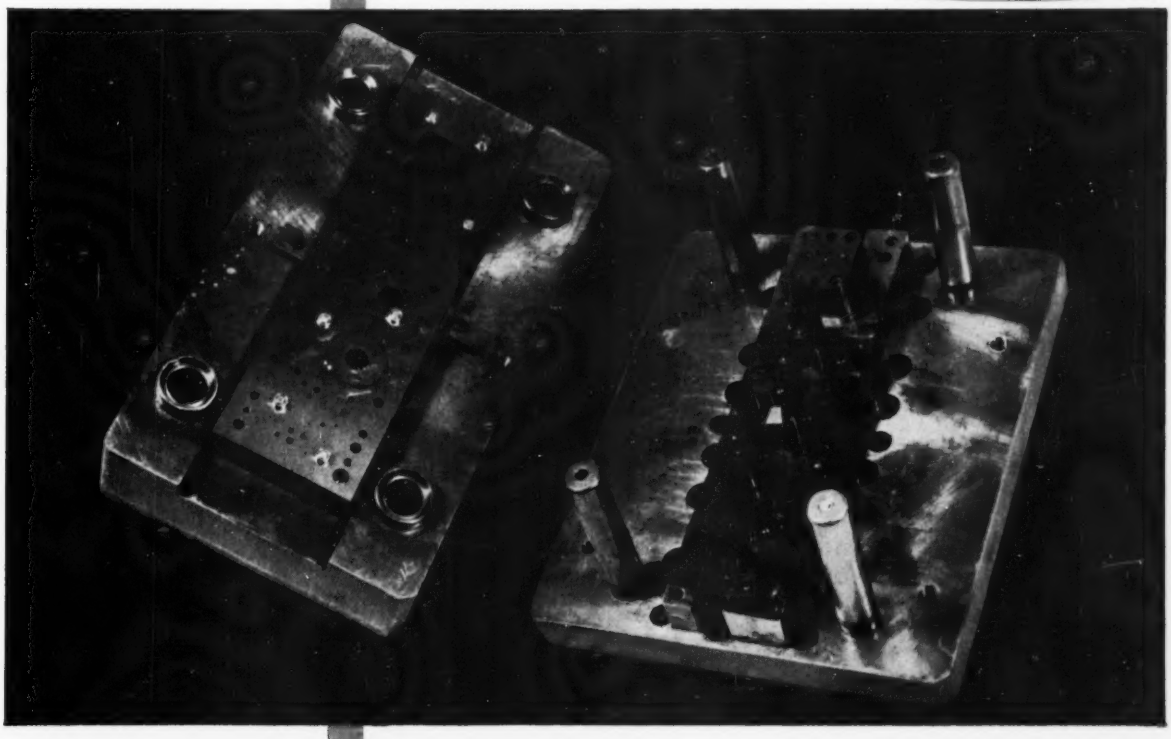
•

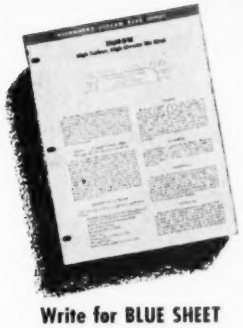
N. A. WOODWORTH COMPANY
1300 EAST 9 MILE ROAD
DETROIT 20, MICHIGAN

For more information on products advertised, use Inquiry Card, page 265



This HURON Lamination Die Gave Initial Run of 426,000!





Write for BLUE SHEET on HURON

This concise four-page folder gives all needed handling and shop treatment details on Huron. Included is certified laboratory information on physical characteristics, and complete data on forging, annealing, hardening, tempering, etc. *Ask for your copy.*

Address Dept. M-55

LUDLUM HURON high-carbon, high-chrome die steel was the material used in this motor lamination die. Here was the result when the die was run on a 45-ton Bliss press at 210 strokes a minute:

1. Initial run was 426,000 pieces
2. Average run since has been 250,000 pieces
3. Although burr tolerance is .003", grinding of punch and die between runs has not exceeded .008"

LUDLUM HURON WAS SELECTED because of its known high resistance to wear, especially under heavy pressures, and its excellent non-deforming qualities. Because Huron is an oil-hardening steel and hardens uniformly to a great depth, a consistent production rate after each grind was assured.

There's an A-L Tool Steel that will help solve your cutting, forming or blanking problem. Call our nearest office or distributor today, or write *Allegheny Ludlum Steel Corporation, Oliver Bldg., Pittsburgh 22, Pennsylvania.*

For complete MODERN Tooling, call Allegheny Ludlum

AL® FINE TOOL STEELS SINCE 1854

W&D 8157

HARDENING EQUIPMENT
Gleason Works, 1000 University Ave., Rochester, N. Y.
Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio.

HARDENING MACHINES, Flame
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Gleason Works, 1000 University Ave., Rochester, N. Y.

HARDNESS TESTING INSTRUMENTS
Olsen, Tinius, Testing Mch. Co., Philadelphia, Pa.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Shore Instrument & Mfg. Co., Van Wyck Ave., and Carll St., Jamaica, N. Y.
Wilson Mechanical Instrument Co., Inc., 230-D Park Ave., New York, N. Y.

HEADING MACHINES
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

HOBBING MACHINES
See Gear Cutting Machines, Spur and Helical Gears (Hobbing), and Gear Cutting Machines, Worm and Worm Wheels.

HOBS
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Hanson-Whitney Co., Div., Whitney Chain Co., Hartford, Conn.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Union Twist Drill Co., Athol, Mass.

HOIST HOOKS
Bethlehem Steel Co., Bethlehem, Pa.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

HOISTING AND CONVEYING EQUIPMENT
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.

HOISTS, Air
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.

HOISTS, Chain, Etc.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

HOISTS, Electric
Philadelphia Gear Works Inc., Erie Ave. and G St., Philadelphia, Pa.

HONING MACHINES, External
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.

HONING MACHINES, Internal (Cylinder)
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Synder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.

HONING STONES
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Moline Tool Co., 102 20th St., Moline, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sunnen Products Co. (Internal & External), 7900 Manchester Ave., St. Louis 17, Mo.

HONING TOOLS AND FIXTURES
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Fulmer, C. Allen, Co., 1231 First National Bank Bldg., Cincinnati 2, Ohio.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.

HOSE, Leather, Rubber, Metallic, Etc.
American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.
Norgren, C. A., Co., Inc., 3419 S. Elati St., Englewood, Colo.

HYDRAULIC MACHINERY Tools and equipment
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Barnes, John S., Corp., Rockford, Ill.
Bethlehem Steel Corp., Bethlehem, Pa.

(*Continued on page* 382)

"Official U. S. photo"

FULMER HONING MACHINES

best and fastest for honing jobs on internal bores

capacity up to 30 inch diameter in a 30 feet long cylinder

This shows one of the largest honing machines ever built capable of honing to AMAZING SMOOTHNESS a cylinder 30 feet long and 30 inches in diameter . . . about as tall as a two-story building. To allow for the extreme size the fixture is mounted on a table with the balance of the machine in a pit directly below.

FULMER HONING MACHINES hone internal bores of any size up to 30 inch diameter with strokes up to 84"—in ferrous or non-ferrous metals, glass, plastic and other materials.

Write for our bulletin on honing.

C. ALLEN FULMER CO.

1231 First National Bank Bldg. Cincinnati 2, Ohio

For more information on products advertised, use Inquiry Card, page 265

NOW WE FORGE IT

DESPITE ITS LARGE SIZE AND INTRICATE SHAPE

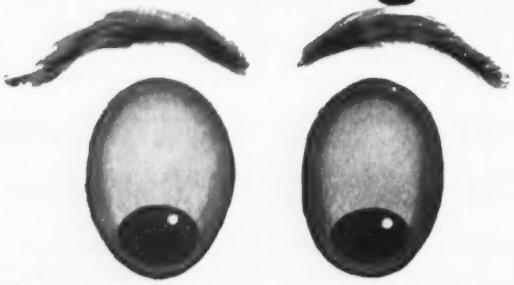
The CAMERON closed die extrusion forging process opens the door to a great many design features which heretofore had been limited to castings. The improved quality and the lower manufacturing cost which result from machining a CAMERON forging makes it highly desirable to investigate the possibility of your product being forged at CAMERON.

For further information write

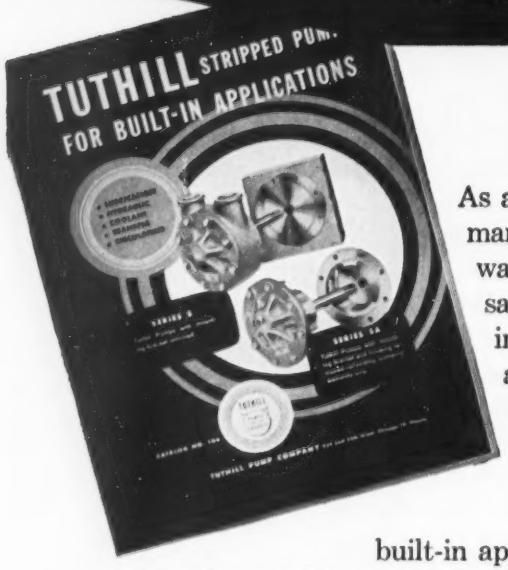
FORGE AND ORDNANCE DIVISION

Cameron IRON WORKS, INC.
HOUSTON, TEXAS

worth looking into...



NOW...a complete new catalog on
TUTHILL STRIPPED PUMPS
for Built-in Applications



As a practical help to manufacturers who want to reduce cost, save space, and improve product appearance, Tuthill now offers Catalog No. 106 on Stripped Pumps for built-in applications.

These dependable pumps are furnished in a wide range of types and sizes for lubrication, hydraulic, coolant and liquid transfer service...in capacities from ⅓ to 200 g.p.m. and pressures to 200 p.s.i.

Write for your copy of Catalog No. 106 today.

TUTHILL
PUMP COMPANY

TUTHILL PUMPS FOR THE PURPOSE

Dependable Rotary Pumps since 1927
939 East 95th Street, Chicago 19, Illinois
Canadian Affiliate: Ingersoll Machine & Tool Co., Ltd., Ingersoll, Ontario, Canada

Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Farquhar, A. B., Div. Oliver Corp., 142 North Duke St., York, Pa.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hanson-Whitney Co., Div., Whitney Chain Co., Hartford, Conn.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Watson-Stillman Co., Div., H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 213 Mill St., Arcade, N. Y.
Wood & Co., R. D., Public Ledger Bldg., Philadelphia, Pa.

HYDRAULIC POWER UNITS OR TOOL HEADS

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, John S., Corp., Rockford, Ill.
Barnes W. F. & John Co., 201 S. Waterford St., Rockford, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

INDEXING AND SPACING EQUIPMENT

Abrasive Mch. Tool Co., Dexter Rd., E. Providence 14, R. I.
Brown & Sharpe Mfg. Co., Providence, R. I.
Engis Equipment Co., 431 S. Dearborn St., Chicago 5, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Sundstrand Mch Tool Co., 2531 11th St., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

INDICATORS, Dial

Alina Corp., 401 Broadway, New York 13, N.Y.
Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Scherr, George, Co., Inc. 200 Lafayette St., New York 12, N. Y.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

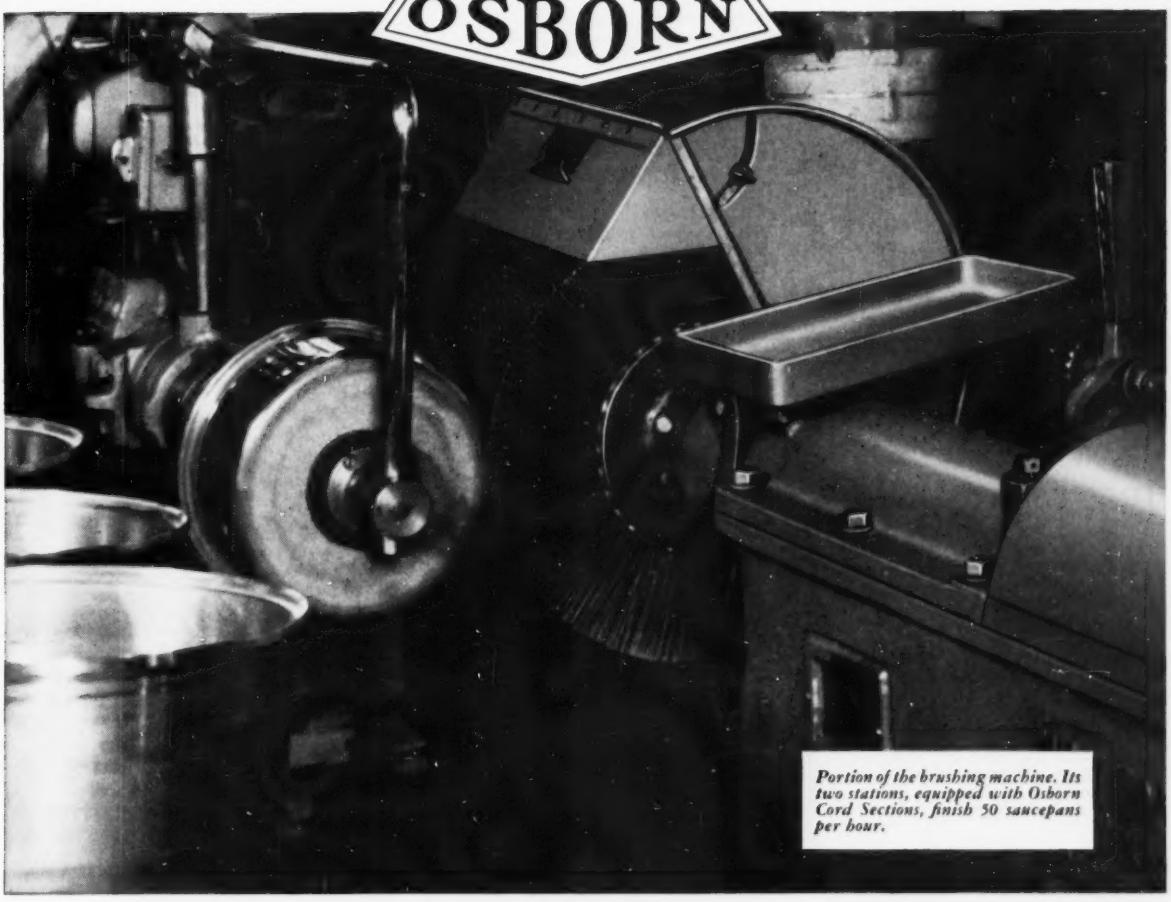
INDICATORS, Speed

Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.

(*Continued on page* 384)

For more information on products advertised, use Inquiry Card, page 265

OSBORN



Portion of the brushing machine. Its two stations, equipped with Osborn Cord Sections, finish 50 saucepans per hour.

Recipe for cooking up a 33% saving

HERE'S how to make stainless steel shine in *two* steps where it formerly took *three:*

This manufacturer of stainless utensils used these operations: (1) Rubbing with 220 oiled grit. (2) Rubbing with 320 oiled grit. (3) Buffing. The **O**sborn **B**rushing **A**nalyst suggested the use of Osborn Cord Sections with stainless steel cut and color compound instead of operations (2) and (3).

Results: The finish is perfectly uniform. Finishing time has been cut 33%.

This is typical of savings being made in finishing of many materials and many products with Osborn Push-Button Brushing methods. Find out how *you* can save. Call your nearby **OBA** or write *The Osborn Manufacturing Company, Dept. D-19, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

Osborn Brushes

OSBORN BRUSHING METHODS • POWER, MAINTENANCE AND PAINT BRUSHES • BRUSHING MACHINES • FOUNDRY MOLDING MACHINES

INDICATORS, Test

Alina Corp., 401 Broadway, New York 13, N.Y.
Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Standard Gage Co. Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INDUCTION HEATING EQUIPMENT

General Electric Co., Schenectady, N. Y.
Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio.

INTENSIFIERS, Hydraulic

Baldwin-Lima-Hamilton Corp., Philadelphia 42.
Farquhar, A. B., Div. Oliver Corp., 142 North Duke St., York, Pa.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Morgan Engrg. Co., Alliance, Ohio.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wood & Co., R. D., Public Ledger Bldg., Philadelphia, Pa.

JACKS, Planer

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.

DOUBLE-CIRCLE TESTING

assures longer life...

more cutting mileage!

● Careful testing at Chicago-Latrobe gives accurate appraisal of the number of holes a DOUBLE-CIRCLE Drill will cut before sharpening becomes necessary. Constant effort by Chicago-Latrobe engineers steadily increases performance. High standards of quality and careful inspection of every manufacturing operation is maintained to meet close tolerance specifications . . . to give you LONGER CUTTING MILEAGE . . . and less shut-down time.

A variety of types and sizes of DOUBLE-CIRCLE Drills meet every requirement . . . General Purpose . . . Heavy Duty . . . Fast Spiral . . . Slow Spiral . . . Bright Spiral . . . Carbide Tipped and Specials. Write for booklet No. 179 for description.

YOU'LL GET QUICK SERVICE→ FROM A CHICAGO-LATROBE DISTRIBUTOR

DOUBLE CIRCLE TOOLS

CHICAGO-LATROBE

617 W. Ontario St., Chicago 10

DRILLS • REAMERS • COUNTERSINKS • COUNTERBORES • CARBIDE TOOLS • SPECIAL TOOLS

JIG BORER

See Boring Machines, Jig.

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Allied Products Corp., 12677 Burt Rd., Detroit 23, Mich.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Columbus Die, Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Machine Co., 2442 Douglas St., Rockford, Ill.
John, B., Manufacturing Co., Ellis St., New Britain, Conn.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
National Broach & Machine Co., 5600 St. Jean St., Detroit 13, Mich.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Woodworth, N. A. Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

JOINTS

See Fittings, Hydraulic, Pneumatic, Etc.

KEYSEATERS

Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Co., Rochester, N. Y.
Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Mitts & Merrill, 68 Holden St., Saginaw, Mich.

KNURL HOLDERS

Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.

KNURLING TOOLS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

LAPPING MACHINES

Barnes Drill Co. (Straight Line or Rotating), 814 Chestnut St., Rockford, Ill.
Cincinnati Grinders, Inc. (Centerless), Cincinnati, Ohio.
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill. (Lapmaster Div.)
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

LAPPING PLATES, Hand

Crane Packing Co., 1800 Cuyler Ave., Chicago.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.

LATHE AND GRINDING DOGS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

LATHE ATTACHMENTS

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.

(*Continued on page 388*)

For more information on products advertised, use Inquiry Card, page 265

More than meets the eye

P-K Socket Screws, at a glance, may look substantially like those you buy from "habit." You have to "look *beyond* the hex" for the difference.

If you don't, you are buying with a "blind spot" that can block your way to *proved* benefits other buyers are using to advantage. Parker-Kalon's exacting Quality Control is only one of the advantages you don't see until you "look beyond the hex."

Look Beyond the Hex

Compare every detail of product and service. Compare for advanced design . . . for proved assembly strength . . . for buying aids, and supply service. Get all the facts, and try P-K Socket Screws. You'll find they take top rating in any test.

Get samples, information from your P-K Distributor, or write: Parker-Kalon Division, General American Transportation Corporation, 202 Varick Street, New York 14, N. Y.

FOR TOP QUALITY and tolerance gaged to your most exacting specifications — and guaranteed.

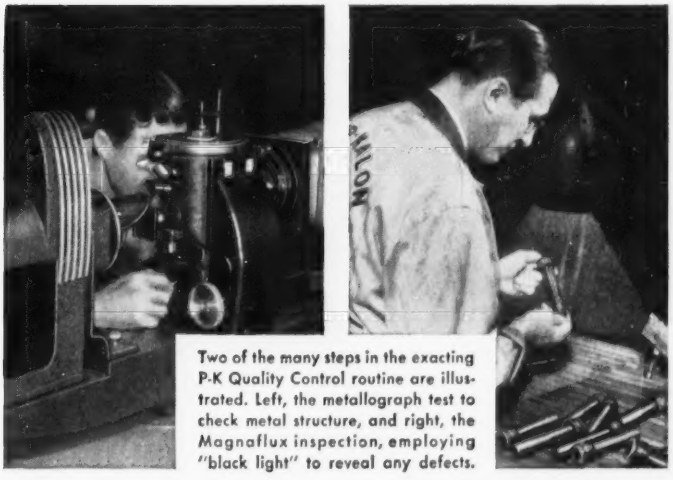
FOR ADVANCED DESIGN that speeds assemblies — makes them simpler, stronger — and saves errors.

FOR ASSEMBLY STRENGTH okayed in a million punishing tests by thousands of satisfied users.

FOR PLANNING AIDS and buying data patterned to your special needs, plus advice on assembly.

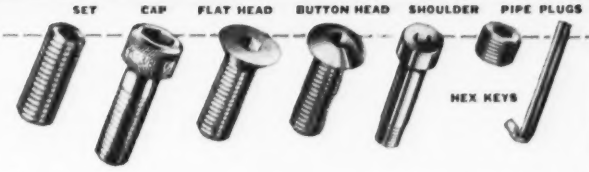
FOR SUPPLY SERVICE set up for fast action and lower purchasing expense — by local Distributors.

FOR ANY STYLE OR SIZE You'll find any Socket Screw you need in P-K's complete line. Hex Keys in all sizes, and several handy sets.



Two of the many steps in the exacting P-K Quality Control routine are illustrated. Left, the metallograph test to check metal structure, and right, the Magnaflux inspection, employing "black light" to reveal any defects.

PARKER-KALON SOCKET SCREWS

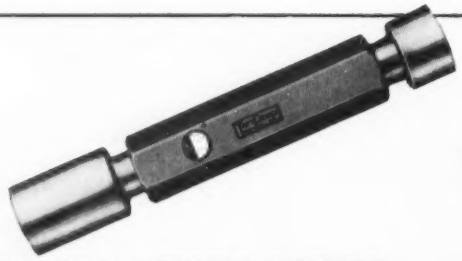


GET ALL THESE ESSENTIALS OF COST-WISE ASSEMBLY GET P-K

In Stock . . . see your nearby P-K Distributor . . . your local Supply and Service Specialist

TIPS FROM TAFT-PEIRCE ON:

How to Gage a Hole



IF IT HAS A SIMPLE DIAMETER

T-P Plain Plug Gages save you money where small quantities are involved or where initial investment must be held to a minimum. Furnished in a wide range of materials, there's a gage for every problem — in hardened tool steel — Electrolized for longer wear — Carbide, Norbide, or Chromium Plated for exceptional resistance to abrasion or scratching. Emmerton Ball Bearing Pilot Plugs can be provided to eliminate end-wear and scoring of soft materials.

ADD A ROTOCHEK

For Greater Speed in checking threads. Push — and the gage screws into the work. Release the pressure and it stops. Pull — and it disengages. Ideal for mass production. Operators report it doubles to triples inspection rates.

IF IT HAS A THREAD

T-P Thread Plug Gages come in a wide variety of styles and materials. Like T-P Ring and Snap Gages, they're available in alloy tool steels, Electrolized, Carbide, Norbide, or Chrome-Plated. This allows you to pick the best combination of cost and wear-resistance for the job.

CHECK THE GAGE FOR ACCURACY

T-P Precision Gage Blocks are the ultimate in accuracy. They provide a dependable master against which to check your production gages. Furnished in small or large sets capable of measuring increments down to 0.00005″. Carbide Wear Blocks are also available to increase the life of your set.

THE TAFT-PEIRCE MANUFACTURING COMPANY

A T-P COMPAIRATOR AIR GAGE

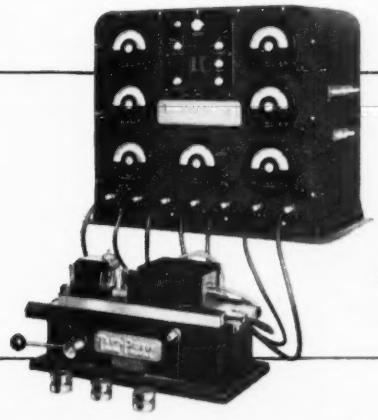
For Greater Speed, Accuracy, Simplicity, and lower maintenance costs. Permits checking diameters from end to end, exploring the work for conditions of taper, out-of-roundness, bellmouth, and other variations. Measures internal diameters as small as .055″.

A T-P COMPUTING COMPAIRATOR

For Problems That Involve making two or more measurements . . . then combining them in a time-wasting calculation — such as determining the center distance or concentricity between two holes without respect to hole size. A T-P Computing CompAIRator does the whole job. Measures, computes, and indicates the result instantly on a single dial. Eliminates human error. Savings in time and dependability alone usually pay for this unit in weeks.

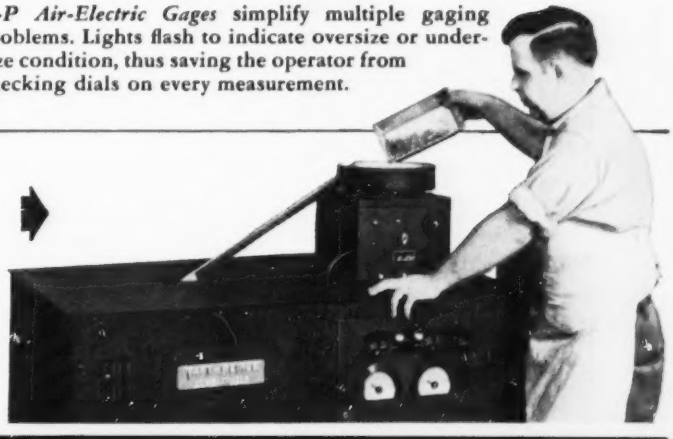
FOR CHECKING WIDE TOLERANCES

This T-P Multi-Dial CompAIRator checks several dimensions simultaneously where tolerances are .120″. Similar units for tolerances up to .125″ can be furnished with any number of indicators and gaging members.



DO IT FASTER, EASIER

T-P Air-Electric Gages simplify multiple gaging problems. Lights flash to indicate oversize or undersize condition, thus saving the operator from checking dials on every measurement.



FOR VERY HIGH PRODUCTION

T-P Automatic Sorting Machines are the ultimate in speed for dimensional inspection. They can be applied to check any reasonable number of dimensions simultaneously. Automatically reject faulty parts, or sort them into size categories.

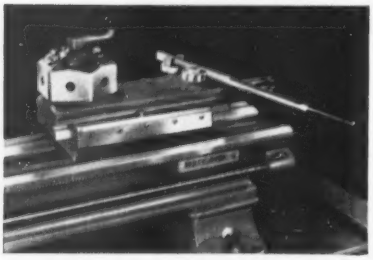
There's a T-P Gage for Every Gaging Problem. For more information on these and many other items, send for your copy of the Taft-Peirce Handbook.

WOONSOCKET, R. I.

T-P means Top Precision

Simplify Repetitive Operations with

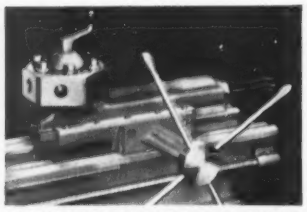
SOUTH BEND TURRETS



HANDLEVER BED TURRET

Indexes ± .0005" at 4". Superfinished index pin. Automatic indexing and feed stops. Effective slide feed 4".

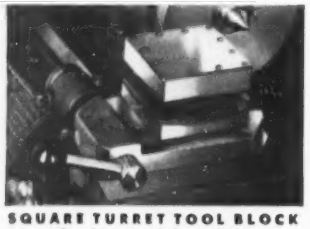
Size Lathe	Catalog No.	Price
9"	CL1611N	$273.
Light Ten	CL1611K	280.
10"	CL1611R	286.
13"	CL1611T	308.



HAND FEED TURNSTILE BED TURRET

Indexes ± .0005" at 4". Automatic indexing and feed stops. 5⅞" feed.

Size Lathe	Catalog No.	Price
16"	CL1917H	$683.



SQUARE TURRET TOOL BLOCK

for Compound Cross Slide

Mounts 4 cutting tools. Turret indexes within .0005" to 4 positions. Quick acting lever lock. For 9" to 16" Lathes — $46 to $91.

TAILSTOCK HANDLEVER TURRET

for 9", 10" and 13" Lathes

Priced as low as $116.

Write for Attachment Bulletin 5321 — Shows 165 Attachments and Accessories.

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South Bend 22, Indiana

Building Better Tools Since 1906

Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P.O. Box 350, Worcester 1, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sidney Machine Tool Co., Sidney, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.
Sunstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHE CONVERTER

Master Mfg Co., Hutchinson, Kansas.

LATHES, Automatic

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Goss & DeLeeuw Mch. Co., Kensington, Conn.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Porter-Cable Machine Co., Salina St., Syracuse, N. Y.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Axle

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co. 2531 11th St., Rockford, Ill.

LATHES, Bench

Casa Corp., 405 Lexington Ave., New York 17, N. Y.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Boring

Bullard Co., Brewster St., Bridgeport 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Sidney Machine Tool Co., Sidney, Ohio.

LATHES, Crankshaft

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Double-End

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Duplicating

H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Sidney Machine Tool Co., Sidney, Ohio.

LATHES, Engine and Toolroom

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Axelson Mfg. Co., P.O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Logan Engrg. Co., 4901 W. Lawrence Ave., Chicago 30, Ill.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Morey Machinery Co., Inc., 383 Lafayette St., New York, N. Y.
Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Sidney Machine Tool Co., Sidney, Ohio.
Simmons Machine Tool Corp., 1600 N. Broadway, Albany, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.

LATHES, Gap

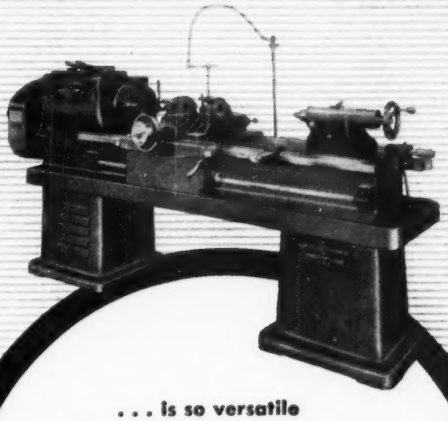
Axelson Mfg. Co., P.O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sidney Machine Tool Co., Sidney, Ohio.
Springfield Mch. Tool Co., Springfield, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

(*Continued on page 390*)

For more information on products advertised, use Inquiry Card, page 265

The COULTER "L1"

AUTOMATIC THREADING LATHE



. . . is so versatile
that hundreds of diameters and
lengths of threads
can be produced on it,
without limitations . . .

FASTER – ACCURATELY – AUTOMATICALLY!

It could be your solution to
low cost threading!
GET the facts!

The James Coulter Machine Co.

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Columbus Die-Tool

It takes the right machinery to build your product right! Columbus Die-Tool individually designs and builds tools, dies, and special machinery to produce your product alone. This gives you the advantages of lower operating cost, greater production and a higher quality product.

Let Columbus Die-Tool's more than 46 years of designing and engineering experience go to work for you. Contact CDT today about your special die, tool and machinery requirements.

Columbus Die-Tool
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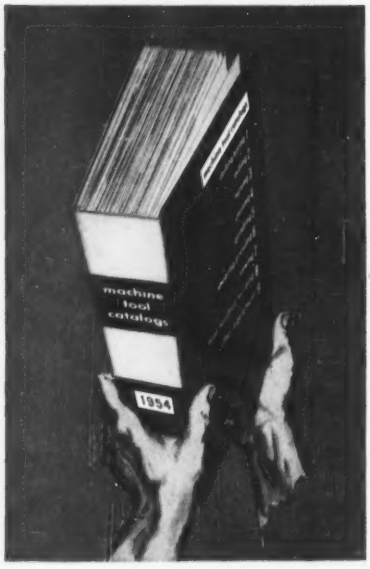
Manufacturers of
JIGS • FIXTURES • BUILDING MACHINE TOOLS COMPLETE
SPECIAL TOOLS • UNITS FOR MACHINE TOOLS

need information on
drilling and boring machines?

reach for Machine Tool Catalogs



"... a great time-saver"

These manufacturers' catalogs are instantly available in Section 1 of your Machine Tool Catalogs:

Carlton Machine Tool Co.	Fosdick Machine Tool Co.
Cincinnati Gilbert Machine Tool Co.	Giddings & Lewis Machine Tool Co.
Cincinnati Lathe & Tool Co.	Hydro-Borer Co.
Consolidated Machine Tool Corp. Sub. Farrel-Birmingham Co., Inc.	Lucas Machine Division New Britain Machine Co.
Davis & Thompson Co.	Ohio Machine Tool Co.
	Snyder Tool & Engineering Co.

ALSO: The following catalogs, in other sections of your Machine Tool Catalogs, contain information on drilling and boring machinery:

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Besly-Welles Corp.	Landis Tool Co.
Boyar-Schultz Corp.	Motch & Merryweather Machinery Co.
Brown & Sharpe Mfg. Co.	New Britain Machine Co.
Bryant Chucking Grinder Co.	Norton Company
Bullard Company	O'Neil-Irwin Mfg. Co.
Dake Engine Company	Plan-O-Mill Corp.
General Mfg. Co.	Rivett Lathe & Grinder, Inc.
Gisholt Machine Co.	Seneca Falls Machine Co.
Greenlee Bros. & Co.	Sundstrand Machine Tool Co.
Hall Planetary Co.	Taft-Peirce Mfg. Co.
Heald Machine Co.	Thomas Machine Mfg. Co.
Johnson Machine & Press Corp.	Verson Allsteel Press Co.
Jones & Lamson Machine Co.	Wales-Strippit Corp.
Kearney & Trecker Corp.	Warner & Swasey Co.
Knight, W. B., Machinery Co.	

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Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Seneca Falls Mch. Co., Seneca Falls, N. Y.

LATHES, Hollow Spindle
Axelson Mfg. Co., P.O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Manufacturing Type
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.

LATHES, Spinning
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Ferracute Machine Co., Bridgeton, N. J.

LATHES, Toolroom
See Lathes, Engine and Toolroom.

LATHES, Turret
Bardons & Oliver Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc., (Bench or Cabinet Mounting), 1418 College Ave., Elmira, N. Y.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Morey Machinery Co., Inc., 383 Lafayette St., New York, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Potter & Johnson Co. (Automatic), 1027 Newport Ave., Pawtucket, R. I.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHES, Vertical Turret
American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

LAYOUT FLUID
Dykem Co., 2303 P. North 11th St., St. Louis 6, Mo.

LEVELS
Bullard Co., Brewster St., Bridgeport 2, Conn.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

LOCKNUTS
Link-Belt Co. (For Positioning Bearings), 519 N. Holmes Ave., Indianapolis 6, Ind.

LUBRICANTS, Including Extreme pressure (EP) Machinery Lubricants
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 120 Lockwood St., Newark 5, N. J.
Shear-Speed Chem. Prod. Div., Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.
Sinclair Refining Co., 600 5th Ave., New York, N. Y.
Standard Oil Co., (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

LUBRICATING SYSTEMS
Farval Corp., 3249 E. 80th St., Cleveland, Ohio.
Madison-Kipp Corp., Madison, Wis.
Norgren, C. A., Co., Inc., 3419 S. Elati St., Englewood, Colo.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

MACHINE KEYS
Gillen, John, Co., Inc., 2540 S. 50th Ave., Cicero 50, Ill.

MACHINE PARTS, Special
Gillen, John, Co., Inc., 2540 S. 50th Ave., Cicero 50, Ill.

MACHINISTS' SMALL TOOLS
See Calipers, Hammers, Wrenches, Drills, Taps, Etc.

MANDRELS
See Arbors and Mandrels.

MARKING MACHINES AND DEVICES
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit, Mich.

MEASURING MACHINES AND INSTRUMENTS, Precision
Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio.
Crane Parking Co., 1800 Cuyler Ave., Chicago.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P.O. Box 1027, Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Starret, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

MEASURING WIRES, THREAD, SPLINE AND GEAR
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

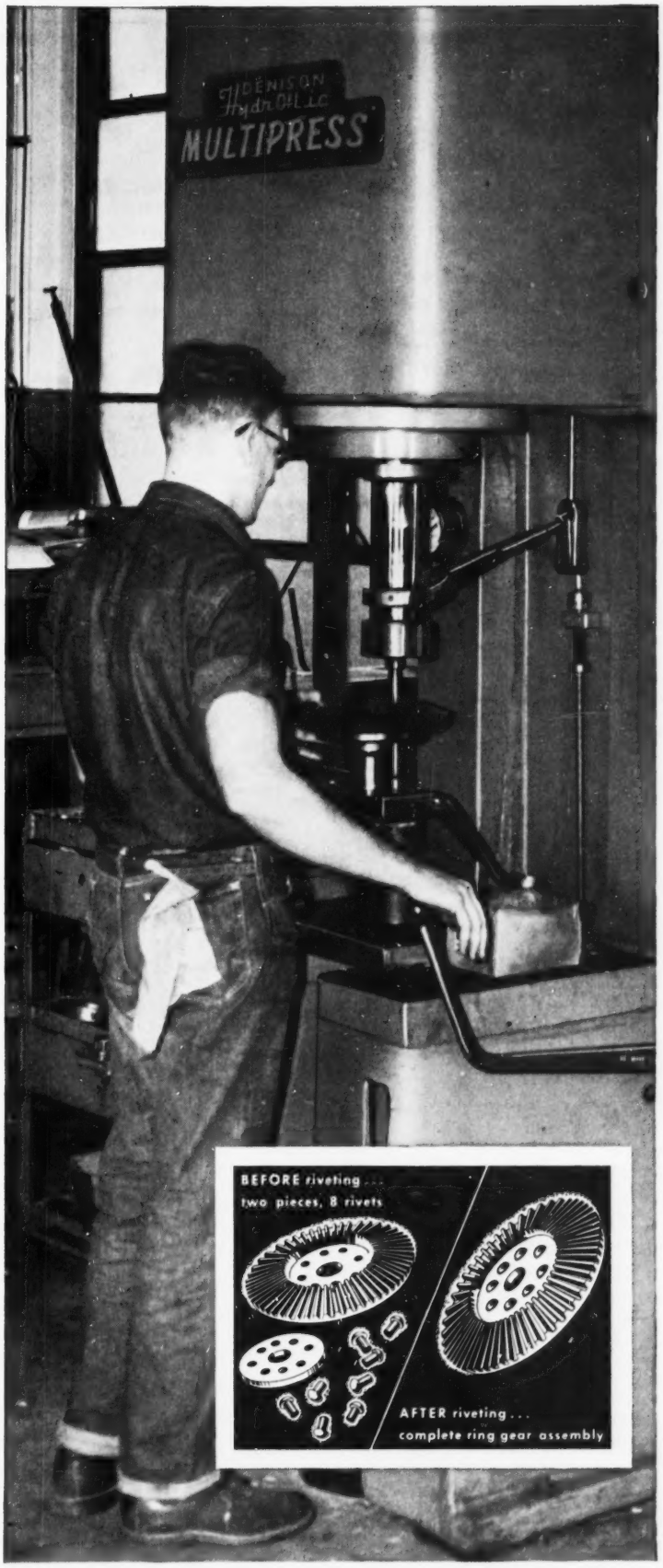
METAL, Bearings
See Bearings, Bronze, Babbitt, Etc., and Bushings, Brass, Bronze, Etc.

METERS
See Recording instruments.

MICROMETERS
Alina Corp., 401 Broadway, New York 13, N. Y.
Ames, B. C., Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

(Continued on page 392)

For more information on products advertised, use Inquiry Card, page 265



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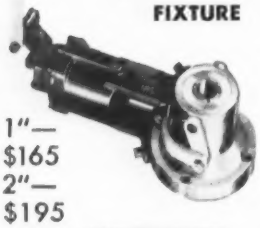

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Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

MILLING ATTACHMENTS

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati.
Consolidated Machine Tool Corp., Rochester, N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING AND CENTERING MACHINES

Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Jones & Lamson Mch. Co. (Automatic), 160 Clinton St., Springfield, Vt.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Automatic

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Kearney & Trecker Corp., Milwaukee, Wis.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Bench

Barker Engrg. Co., 500 Green Rd., Cleveland 21, Ohio.
Hardinge Bros., Inc. (Bench or Pedestal Type), 1418 College Ave., Elmira, N. Y.
Pratt & Whitney, West Hartford 1, Conn.

MILLING MACHINES, Circular Continuous

Consolidated Machine Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Duplex

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Hand

Barker Engrg. Co., 500 Green Rd., Cleveland 21, Ohio.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Horizontal, Plain and Universal

Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Marac Machinery Corp., 45 So. Broadway, Yonkers, N. Y.
Orban Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney West Hartford 1, Conn.
Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Lincoln Type

Brown & Sharpe Mfg. Co., Providence, R. I.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Planer Type

Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn. R. R., Evanston, Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Pratt & Whitney West Hartford 1, Conn.

MILLING MACHINES, Profile

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Ram Type Universal

Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Turret Type

Bridgeport Machines, Inc., Linley Ave., Bridgeport, Conn.

(*Continued on page 394*)

For more information on products advertised, use Inquiry Card, page 265

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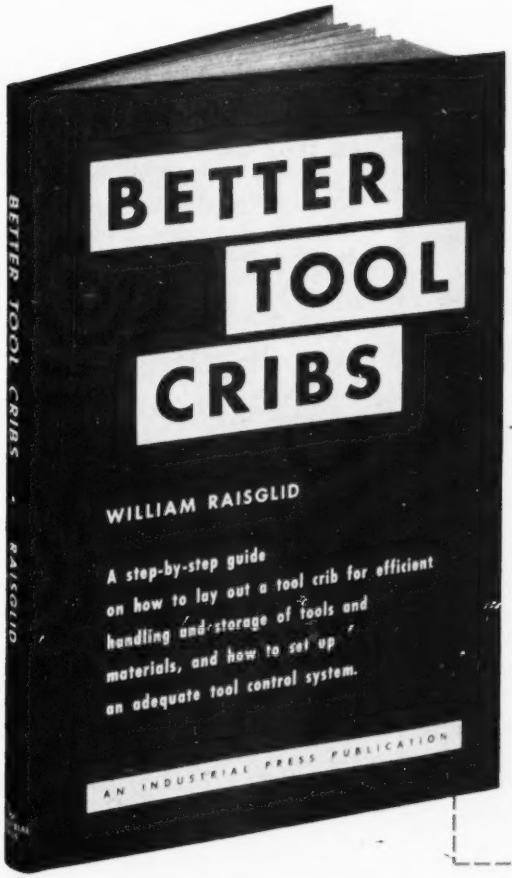
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Ekstrom, Carlson & Co., 1437 Railroad Ave., Rockford, Ill.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Marac Machinery Corp., 45 So. Broadway, Yonkers, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Snyder Tool & Engrg. C., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MODEL AND EXPERIMENTAL WORK
See Special Machinery and Tools.

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Cosa Corp., 405 Lexington Ave., New York 17.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Pratt & Whitney, West Hartford 1, Conn.

MOLDING MACHINES, Plastic
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Rockford Machine Tool Co., 2500 Kiswaukee St., Rockford, Ill.
Watson-Stillman Co., Div., H. K. Porter Co., Inc., Roselle, N. J.

MOTORS, Electric
Delco Products Div., General Motors Corp., 321 E. First St., Dayton, Ohio.
General Electric Co., Schenectady, N. Y.
Howell Electric Motor Co., Howell, Mich.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.

MOTORS, Hydraulic
Gerotor May Corp., Oliver St. and Maryland Ave., Baltimore, Md.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

MULTIPLE-SLIDE FORMING MACHINES
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

NIBBLING MACHINES
Campbell Machine Div., American Chain & Cable Co., Inc., 929 Connecticut Ave., Bridgeport, Conn.

NIBBLING MACHINES, Nickel
International Nickel Co., Inc., 67 Wall St., New York, N. Y.

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Landis Machine Co., Inc., Waynesboro, Pa.

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Parker-Kalon Div., General American Transportation Corp., 200 Varick St., New York, N. Y.
Republic Steel Corp. (Union Drawn Steel Div.), Republic Bldg., Cleveland 1, Ohio.
Union Drawn Steel Co., Div., Republic Steel Corp., Massillon, Ohio.

NUTS, Self-locking
Elastic Stop Nut Corp., 2330 Vauxhall Rd., Union, N. J.
Grip Nut Co., 310 S. Michigan Ave., Chicago 4, Ill.

NUTS, Thumb or Wing and Cap
Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only).
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Republic Steel Corp., Bolt and Nut Div., Republic Bldg., Cleveland 1, Ohio.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Garlock Packing Co., Palmyra, N. Y.

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Gits Bros. Mfg. Co., 1846-62 Kilbourn Ave., Chicago, Ill.
Madison-Kipp Corp., Madison, Wis.
Norgren, C. A., Co., Inc., 3419 S. Elati St., Englewood, Colo.

OILS, Cutting
See Cutting and Grinding Fluids.

OILS, Lubricating
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Sinclair Refining Co., 600 5th Ave., New York.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

OILS, Quenching and Tempering
Cities Service Oil Co., 70 Pine St., New York, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Sinclair Refining Co., 600 5th Ave., New York.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago 23, Ill.

(*Continued on page 396*)

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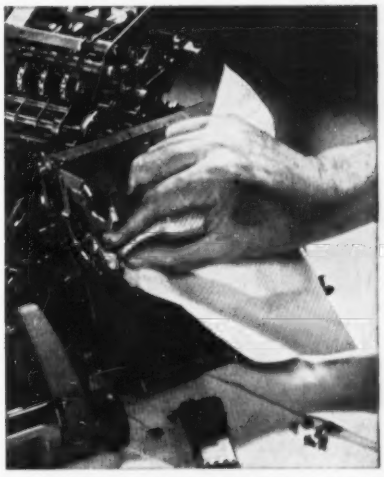

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OILS, Soluble

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OPTICAL FLATS

Crane Packing Co., 1800 Cuyler Ave., Chicago.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

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Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.

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Crane Packing Co., 1800 Cuyler Ave., Chicago.
Garlock Packing Co., Palmyra, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Waston-Stillman Co., Div., H. K. Porter Co., Inc., Roselle, N. J.

PAINTING EQUIPMENT, Spray

Lowe Bros. Co., Dayton, Ohio.

PARALLELS

Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Co., Inc., Worcester, Mass.

PATTERNS, Wood and Metal

Mummert-Dixon Co., Hanover, Pa.

PILLOW BLOCKS

Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

PIPE, BRASS AND COPPER

American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Revere Copper & Brass Inc. 230 Park Ave., New York, N. Y.

PIPE STEEL

Alleghany Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
United States Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

PIPE THREADING AND CUTTING MACHINES

Landis Machine Co., Inc., Waynesboro, Pa.

PIPE TONGS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

PLANER ATTACHMENTS

Consolidated Mch. Tool Corp., Rochester, N. Y.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn R. R., Evanston, Cincinnati, Ohio.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.

PLANERS, Double Housing and Openside

Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio (Plate).
Consolidated Mch. Tool Corp. (Incl. Plate, Rotary and Crank Types), Rochester, N. Y.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn R. R., Evanston, Cincinnati, Ohio.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.

PLATE ROLLS

Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

PLATES, Surface

Brown & Sharpe Mfg. Co. Providence, R. I.
Challenge Machinery Co., Grand Haven, Mich.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Pratt & Whitney Div., West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Vinco Corp., 9113 Schaefer Highway, Detroit 28, Mich.

PNEUMATIC EQUIPMENT

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago.
Ingersoll-Rand Co., Phillipsburg, N. J.
Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
Norgren, C. A., Co., Inc., 3419 S. Elati St., Englewood, Colo.
Onsrud Machine Works Inc., 3940 Palmer St., Chicago, Ill.

POLISHING LATHES AND MACHINES

Black & Decker Mfg. Co., Penna. Ave., Towson, Md.
Gardner Machine Co., (Div. Landis Tool Co.), 414 E. Gardner St., Beloit, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave. Kalamazoo 54, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Millers Falls Co., Greenfield, Mass.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

POLISHING TOOLS, Portable

Jarvis, Charles L., Co., Middletown, Conn.
Sunstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

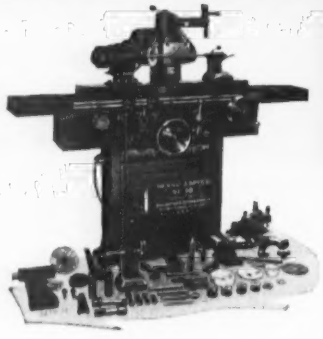
POWER UNITS, Hydraulic

See Hydraulic Power Units or Tool Heads

(*Continued on page 398*)

NOW! improved delivery

OF GRAND RAPIDS UNIVERSAL CUTTER AND TOOL GRINDERS



It's true, they have been hard to get because every model offers extra value.

The Model 62, for instance, features four-speed spindle drive, universal positioning of elevating hand wheel, anti-friction ways, more vertical capacity, longer swing, one-shot lubrication system.

The many other Grand Rapids Cutter Grinders are also on improved delivery schedules. Send coupon for complete information.

Get the full story on all the advantages

GALLMEYER & LIVINGSTON CO.
425 Straight Ave., Grand Rapids, Mich.
Please send me the following literature without obligation:
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We'll answer within twenty-four hours

GALLMEYER & LIVINGSTON

Production Increased

53%

when

MORSE CHAIN CO.

Borg-Warner Industry

Installed the EDLUND 2F

From 85 pieces per hour to 130 pieces per hour

EDLUND engineered drilling and tapping machines can solve your drilling problems

PROBLEM: To Manufacture 1820 parts in a two shift day, where the drilling operation was the bottleneck.
Material: Medium Cast Iron
Operation: Drill 2 Holes (11/32" dia.)
Drill and Ream 1 Hole
.3115" to .3130" in Sprocket Hub

OLD METHOD: Drill one Sprocket at a time in lever type fixture using multi-head and step drill for reamed hole.

NEW METHOD: Drill two sprockets at a time using Edlund 2F-8" Power Feed
2-Spindle Drill on a 3-spindle base
A Drill Plate Type Fixture held the Sprocket.

RESULTS: Production of 1820 pcs. in 14 hours using the Edlund 2F, compared with 23 hours using the old method. Drill life was increased because of more accurately controlled speed and feed.

2F

Infinitely Variable Speed

EDLUND

Greatest Advance in Drilling Machines in the Past 25 Years

Use coupon below to request information.

Edlund Applied Experience Will Save You Money

In plant after plant Edlund Drilling Machines have solved production problems.

When you buy an Edlund, you get not only an excellent machine embodying fine design and workmanship, you also profit from years of Edlund engineering experience in solving all kinds of drilling problems.

Just as Edlund was the answer to the drilling problem of the Morse Chain Co., Edlund could be the answer to your drilling problem.

DIVISION OF BRADLEY EDLUND CORP.
[A] Affiliated with Precision Castings Co., Inc.

EDLUND [A] MACHINERY CO.
Cortland, N. Y.

- ☐ Send me Bulletin 140 on the Edlund 2F.
- ☐ Have a representative call ☐ immediately ☐ when convenient

Name_____

Company_____

City_____ State_____

PRESSES, Air

Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.

PRESSES, Arbor

Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Farquhar, A. B., Div Oliver Corp., 142 North Duke St., York, Pa.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Logansport Machine Co., Inc., 810 Center Ave., Logansort, Ind.
Tomkins-Johnson Co., 614 No. Mechanic St., Jackson, Mich.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 213 Mill St., Arcade, N. Y.

PRESSES, Broaching

American Broach & Mch. Co., Ann Arbor, Mich.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Farquhar, A. B., Div. Oliver Corp., 142 North Duke St., York, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

PRESSES, Extrusion

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Farquhar, A. B., Div. Oliver Corp., 142 North Duke St., York, Pa.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

PRESSES, Foot

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.

PRESSES, Forging

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E. Cleveland, Ohio.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Div. Oliver Corp., 142 North Duke St., York, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Morgan Engrg. Co., Alliance, Ohio.
National Mchry. Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 213 Mill St., Arcade, N. Y.
Wood & Co., R. D., Public Ledger Bldg., Philadelphia, Pa.

PRESSES, Hydraulic

American Broach & Mch. Co., Ann Arbor, Mich.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Erie Foundry Co., Erie, Pa.
Farquhar, A. B., Div. Oliver Corp., 142 North Duke St., York, Pa.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Morgan Engrg. Co., Alliance, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 213 Mill St., Arcade, N. Y.
Wood & Co., R. D., Public Ledger Bldg., Philadelphia, Pa.

PRESSES, Pneumatic

Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.

PRESSES, Screw

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.

PRESSES, Sheet Metal Working

Allen, Alva F., Box 426, Clinton, Mo. (Bench)
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Philadelphia 42, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Espen-Lucas Machine Works, Front St., and Girard Ave., Philadelphia, Pa.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Farquhar, A. B., Div., Oliver Corp., 142 North Duke St., York, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
L & J Press Corp., Elkhart, Ind.
Minster Machine Co., Minster, Ohio.

(*Continued on page* 400)

To everyone this is a sign of peace

And to smart gear users this CINTI is a sign of *good* gears.

CINTI "Gears... Good Gears Only"

THE CINCINNATI GEAR CO. • CINCINNATI 27, OHIO

For more information on products advertised, use Inquiry Card, page 265

. . . *but*
Experience Cannot be Copied

More than a quarter-century ago MARVEL invented and basically patented the MARVEL High-Speed-Edge Hack Saw Blade—the UNBREAKABLE blade that increased hack sawing efficiency many-fold.

Every MARVEL Hack Saw Blade ever sold has been of that basic welded high-speed-edge construction, with constant improvements from year to year, as EXPERIENCE augmented the "know-how" . . .

MARVEL is not "tied" to any single source of steel supply, and has always used the best high speed steels that became available from time to time as metallurgy progressed. When-as-and-if finer steels are developed—and are proven commercially practical for welded-edge hack saw blades—MARVEL will use them, regardless of cost or source . . .

There is only one genuine MARVEL High-Speed-Edge! All other "composite" or "welded-edge" hack saw blades are merely flattering attempts to imitate — without the "know-how" of MARVEL EXPERIENCE . . .

Insist upon *genuine* MARVEL High-Speed-Edge when buying hack saw blades—and be SAFE, for you can depend upon MARVEL. They have been "tested", "pre-tested", and "re-tested" by thousands of users for more than a quarter-century!

MARVEL *Metal Cutting* SAWS

Better Machines—Better Blades

ARMSTRONG-BLUM MFG. CO. • 5700 Bloomingdale Ave. • Chicago 39, U. S. A.

Keep the $ Value in your OIL$

Special purpose industrial oils seldom wear out—they become contaminated with metal particles, water, carbon, and other contaminants. Then they become increasingly useless—in fact harmful to the point of being costly burdens on production and equipment.

A Sharples Oil Purifier is the simple, direct cure for these problems. By means of high centrifugal force, the solid impurities are deposited on the inner wall of the tubular bowl; the water is continuously discharged from one spout, and the purified oil is continuously discharged from another spout.

Bowl cleaning is quick—only 10 minutes and you're back in service. No hoist required; no cartridges to replace. And the Sharples requires less attention than just about any operating equipment in your plant.

Industrial oils of all kinds are being kept at maximum efficiency with Sharples Oil Purifiers—machining, grinding, quenching, test, break-in, honing, to mention but a few types of oils.

Purify for added profit—get the facts from Sharples. Write for Bulletin 1270 for Cutting Oils, and Bulletin 1264 for other industrial oils.

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THE SHARPLES CORPORATION • 2300 WESTMORELAND ST. • PHILA. 40, PA.

NEW YORK • PITTSBURGH • CLEVELAND • DETROIT • CHICAGO
NEW ORLEANS • SEATTLE • LOS ANGELES • SAN FRANCISCO • HOUSTON

Associated Companies and Representatives throughout the World

Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Sales Service Mch. Tool Co., 2363 University Ave., St. Paul, Minn.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 213 Mill St., Arcade, N. Y.

PRESSES, Straightening

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Anderson Bros., Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Farquhar, A. B., Div., Oliver Corp., 142 North Duke St., York, Pa.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hufford Machine Works, Inc., 1700 E. Grand Ave., El Segundo, Cal.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Morgan Engrg. Co., Alliance, Ohio.
Niagara Machine & Tool Works (Hydraulic), 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Springfield Mch. Tool Co., Springfield, Ohio.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 213 Mill St., Arcade, N. Y.

PROFILE—TRACING ATTACHMENTS

Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa. (Lathe).

PROFILING MACHINES

Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp, 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis.
Morey Machinery Co., Inc., 383 Lafayette St., New York, N. Y.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

PULLEYS

Boston Gear Works, 3200 Main St., North Quincy 71, Mass.

PULLEYS, Friction Clutch

Brown & Sharpe Mfg. Co., Providence, R. I.

PUMPS, Coolant, Lubricant and Oil

Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., 620 E. Vienna Ave., Milwaukee, Wis.
Ingersoll-Rand Co., Phillipsburg, N. J.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Ruthman Machinery Co., 1809 Reading Rd., Cincinnati 12, Ohio.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tompkins-Johnson Co., Jackson, Mich.
Vickers Inc., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

PUMPS, Hydraulic

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Barnes, John S., Corp., Rockford, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engrg. Co., Chambersburg, Pa.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.

(*Continued on page* 402)

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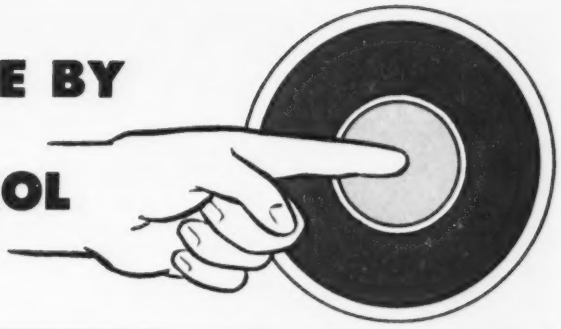
CUT YOUR DOWN-TIME BY PUSH-BUTTON CONTROL



SAVE COSTLY TIME WITH PENDANTS

From conveniently placed pendants you control table speeds, feeds and rapid motion of turret, cross-rail, and side arm tools—all done easily and rapidly by push-buttons and switches.

SAVE COSTLY TIME WITH ELECTRO-MAGNETIC CLUTCHES

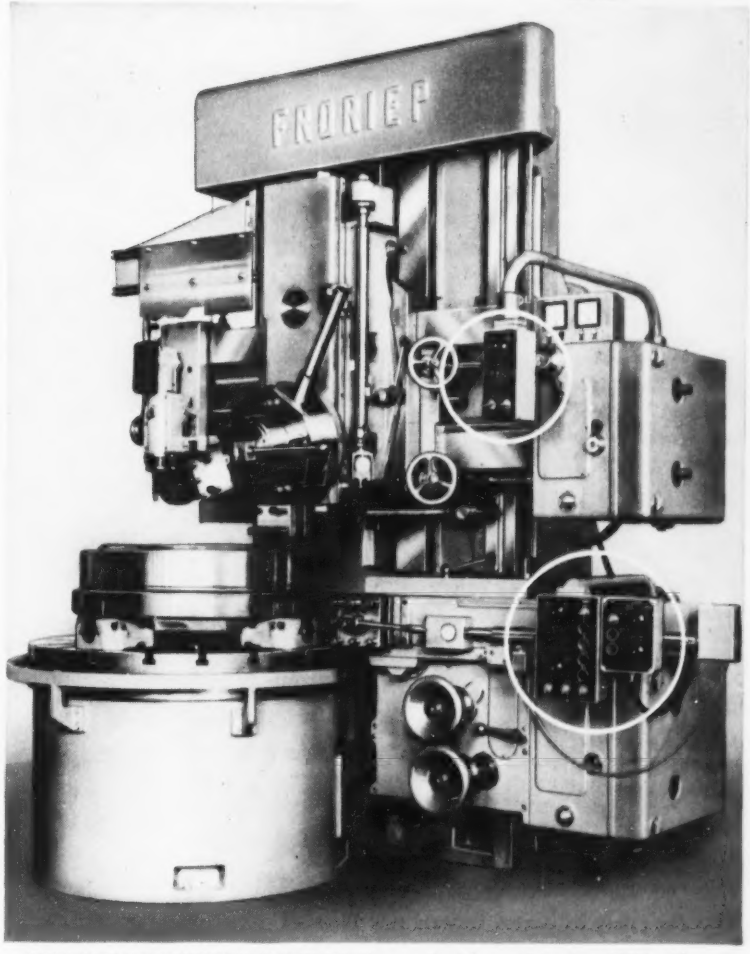
No more gear shifting—push-button speed-changes are so fast you can make them while the machine is cutting without leaving marks on the workpiece. Now you can maintain constant cutting speed without interrupting cut.

SAVE COSTLY TIME WITH ELECTRO-COPYING DEVICE

Now, automatic copy-turning from templates can be done by means of electro-magnetic clutches. Speeds and feeds are pendant controlled.

SAVE COSTLY TIME WITH AUTOMATIC STOPS

No need for laborious moving of tools into position on production runs—tools can be positioned rapidly and automatically by means of pre-set electrical stops. Only finest adjustments are made by hand and dial indicator.



FRORIEP KE SUPER VERTICAL TURRET LATHE comes in 4 heavy-duty sizes: KE10 with 40" table; KE12, 49" table; KE14, 55" table; KE16, 63" table. Each model has 18 table speeds—side arm and turret have 12 feeds each. Heavy, rigid construction makes possible an excellent surface finish on workpieces.

There's more to this story: you can get an attachment for taper turning and thread cutting, another for automatically maintaining constant cutting speeds, and you can select other accessories. Price, too, is a feature of this machine. Want all the facts? Get in touch with us.

COSA—*nationwide sales and service of precision machine tools—from bench lathes to boring mills.*

COSA CORPORATION, 405 LEXINGTON AVENUE, NEW YORK 17, N.Y.

For more information on products advertised, use Inquiry Card, page 265

Rolling Precision Aircraft Parts on REED Cylindrical Die Thread Rollers

The Aircraft Industry selects the Thread Rolling Process as the preferred method of threading aircraft parts.

Thread rolling reproduces the precision thread form of the thread rolling dies and maintains the original accuracy of the setup over long runs.

The cold forging action of thread rolling produces a thread that is substantially stronger and tougher than similar threads produced by other processes.

Send us specifications of your requirements and let us supply you with complete information.

REED ROLLED THREAD DIE CO.

THREAD ROLLING MACHINES and DIES • KNURLS • THREAD ROLLS
Worcester, Massachusetts, U. S. A.

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Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Ingersoll-Rand Co., Phillipsburg, N. J.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.
Vinco Corp., 9113 Schaefer Highway, Detroit 28, Mich.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

PUMPS, Pneumatic
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

PUMPS, Rotary
Brown & Sharpe Mfg. Co., Providence, R. I.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Tuthill Pump Co., 939 E. 95th St., Chicago 19, Ill.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

PUNCHES AND DIES
See Dies, Sheet Metal, Etc.

PUNCHES, Centering
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.

PUNCHING MACHINERY
Allen, Alva F., Box 426, Clinton, Mo.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Famco Machine Tool Co., 3134 Sheridan Rd., Kenosha, Wis.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Ryerson, Joseph T., & Son Inc., 2558 W. 16th St., Chicago 18, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wiedemann Machine Co., 4272 Wissahickon Ave., Philadelphia, Pa.

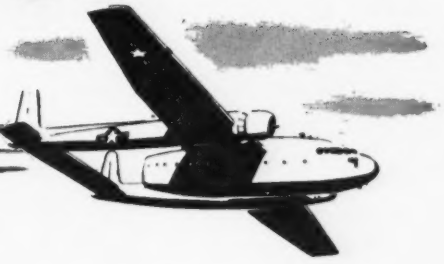
RACKS, Gear Cut
Amgears, Inc., 6633 W. 65th St., Chicago 38, Ill.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Massachusetts Gear & Tool Co., 36 Nassau St., Woburn, Mass.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

REAMER HOLDERS
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
McCosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Warner & Swasey Co., 8701 Carnegie Ave., Cleveland 3, Ohio.

(*Continued on page* 404)

For more information on products advertised, use Inquiry Card, page 265

the FIRE TRUCK *that flies*

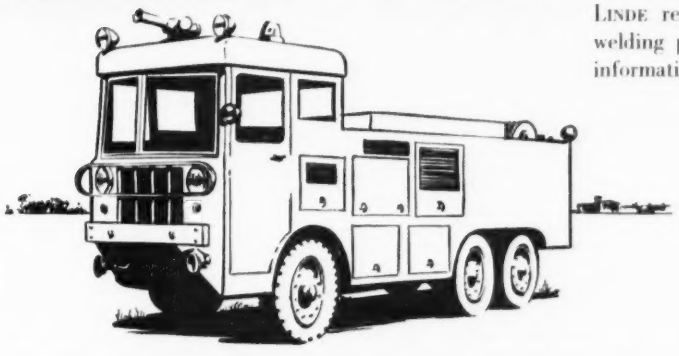


From rumbling horse drawn wagons, to the massive pump-trucks of today—weight has been the common characteristic of mobile fire-fighting equipment.

However, with the expanding science of fire-fighting, there came new demands of equipment. The United States Air Force had need for fire trucks fully equipped, yet light enough to be carried by air to landing strips the world over. Such trucks are now in production—fabricated by HELIARC and sigma welding.

The fire truck's rigid lightweight all-aluminum body, which varies in thickness from 14 ga. to ¾ in., is completely welded by HELIARC and sigma welding at speeds up to 25 in. per minute. Because welding speed is high, and inert gas welding eliminates expensive post-weld cleaning, this manufacturer turns out three units a day—employing only 40 men.

Research and years of experience have helped LINDE to develop a top notch team of fabricating processes—HELIARC, sigma and UNIONMELT welding. For small shops or huge production lines, from carbon steel to complex alloys and non-ferrous metals—there is a LINDE electric welding process to do the job efficiently and economically. Your local LINDE representative will help you determine the best welding process for your job. Call him today for more information.



Linde
TRADE-MARK

LINDE AIR PRODUCTS COMPANY
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.
Offices in Principal Cities

In Canada: DOMINION OXYGEN COMPANY
Division of Union Carbide Canada Limited

"Heliarc," "Unionmelt," and "Linde" are registered trade-marks of Union Carbide and Carbon Corporation.

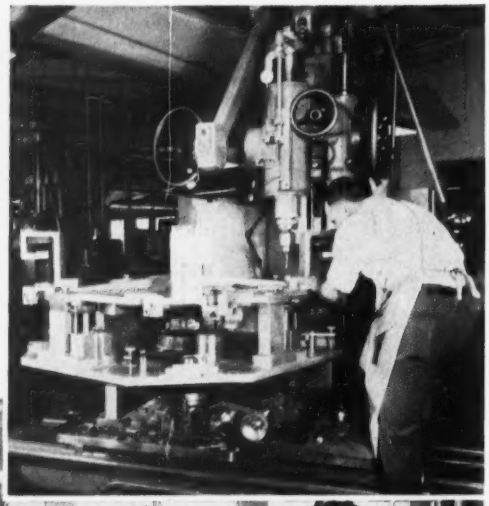
TOUGH PROJECTS OR PRECISION PRODUCTION CALLS FOR CONTRACT JIG BORING BY B. Jahn

BATTERIES OF THE LATEST JIG BORERS MANNED BY MASTER TOOLMAKERS MAINTAIN YOUR SPECIFICATIONS

. . . SCHEDULES

. . . SATISFACTION!

Jig boring a huge radar housing fixture. Over 200 individual holes were held to ten-thousandths tolerances.



In the large B. Jahn plant, 16 modern jig borers — in every size — are at the service of industry.

B. Jahn engineering superiority is continuously overcoming seemingly insurmountable jig boring obstacles. Whether it be a single fixture or a production run — a simple task or a real production headache — investigate B. Jahn contract jig boring and the dividends of time saved, money saved it can pay you.

DESIGN AND CONSTRUCTION OF DIES • TOOLS • JIGS • FIXTURES • GAGES • SPECIAL MACHINERY • JIG GRINDING • JIG BORING • KELLER DUPLICATING

FACILITY LIST AND LITERATURE SENT ON REQUEST. QUOTATIONS HANDLED PROMPTLY.

B. Jahn

B. JAHN MANUFACTURING COMPANY NEW BRITAIN, CONNECTICUT

REAMERS

Atrax Co., Newington, Conn.
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 27, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp, Greenfield, Mass.
Haynes Stellite Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Keo Cutters, 19326 Woodward, Detroit, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
McCosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

REAMERS, Adjustable

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

REAMERS, Taper Pin

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Kaufman Manufacturing Co., Manitowoc, Wis.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

REAMING MACHINES

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Greaves Machine Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
Kaufman Manufacturing Co., Manitowoc, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

RECORDING INSTRUMENTS for Counting

National Acme Co., 170 E. 131st St., Cleveland, Ohio.

(*Continued on page* 406)

For more information on products advertised, use Inquiry Card, page 265

September in Italy

800 Exhibitors from 12 Countries

700,000 square feet of exhibition space

For information:

Commissariato Generale
4ª Esposizione Europea della Macchina Utensile
Ente Autonomo Fiera di Milano
Via Domodossola
Milano, Italy

Lodgings:

Ente Provinciale per il Turismo
Via Dogana 4, Milano
Telephone: 870016
Telegrams: Enturismo Milano

OLSEN

Makes Balancing History

with a complete line of

Elec⊕dyne

Static-Dynamic Balancing Machines

- **Instantaneous Unbalance Indication** The exclusive Olsen Elec⊕dyne takes the guesswork out of balancing . . . instantly indicates the amount and angle of unbalance on two large meters. Even minute quantities of unbalance are quickly pinpointed by this highly sensitive electronic indicating system.
- **Ease of Operation** Operator merely inserts the part and starts the machine. In a matter of seconds he knows the angle and amount of indication for both planes of correction.
- **Positive Plane Separation** The pivoted cradle, an Olsen exclusive, provides positive plane separation . . . only the unbalance in the selected plane of correction is measured by the Elec⊕dyne.
- **Simplicity of Calibration** Both the Angle and Amount Meters can be calibrated quickly with the aid of a screw driver. Expensive "masters," and trial and error methods to obtain a "zero" unbalance are eliminated.
- **Production Line Balancing** is a reality with the Olsen Elec⊕dyne—your best investment for rapid, accurate and low cost balancing.

Bulletin 49 contains details on the complete line of Olsen Elec⊕dyne Balancing Machines. Write for your copy.

TINIUS ⊕ OLSEN

Testing & Balancing Machines

TINIUS OLSEN TESTING MACHINE CO.

2080 Easton Road · Willow Grove, Pa.

REELS, Stock, Standard and Automatic
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

REFRACTORS, Heat-Treating Furnace
Norton Co., 1 New Bond St., Worcester 6, Mass.

REGULATORS, Temperature
General Electric Co., Schenectady, N. Y.

REMOVERS, Japan, Enamel, Etc.
Oakite Products, Inc., 19 Rector St., New York, N. Y.

RETAINING RINGS FOR BEARINGS, Etc.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Wades-Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

RHEOSTATS
Allen-Bradley Co., 1326 S. 2nd St., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.

RIVET SETS
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.

RIVETERS, Hydraulic
Bethlehem Steel Co., Bethlehem, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hanna Engineering Works, 1752 Elston Ave., Chicago, Ill.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Morgan Engrg. Co., Alliance, Ohio.

RIVETERS, Pneumatic
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Grant Mfg. & Machine Co., 90 Silliman St., Bridgeport 5, Conn.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Wood & Co., R. D., Public Ledger Bldg., Philadelphia, Pa.

RIVETING MACHINES
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Grant Mfg. & Machine Co., 90 Silliman St., Bridgeport 5, Conn.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Tomkins-Johnson Co., Jackson, Mich.

RIVET MAKING MACHINES
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

RUBBER PRODUCTS
Garlock Packing Co., Palmyra, N. Y.

RULES, Steel
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S. Co., Athol, Mass.

RUST PREVENTIVES
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

SAND BLAST EQUIPMENT
See Blast Cleaning Equipment

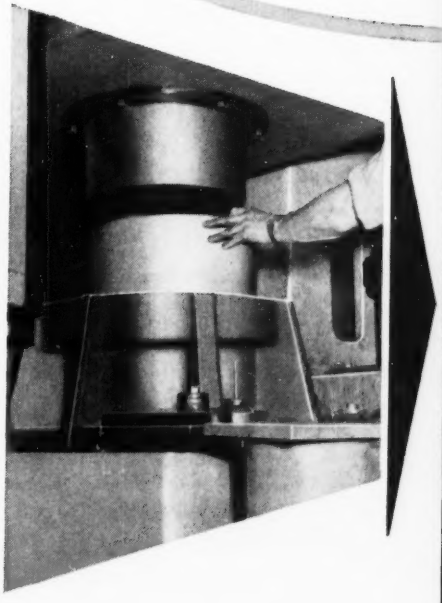
(Continued on page 408)

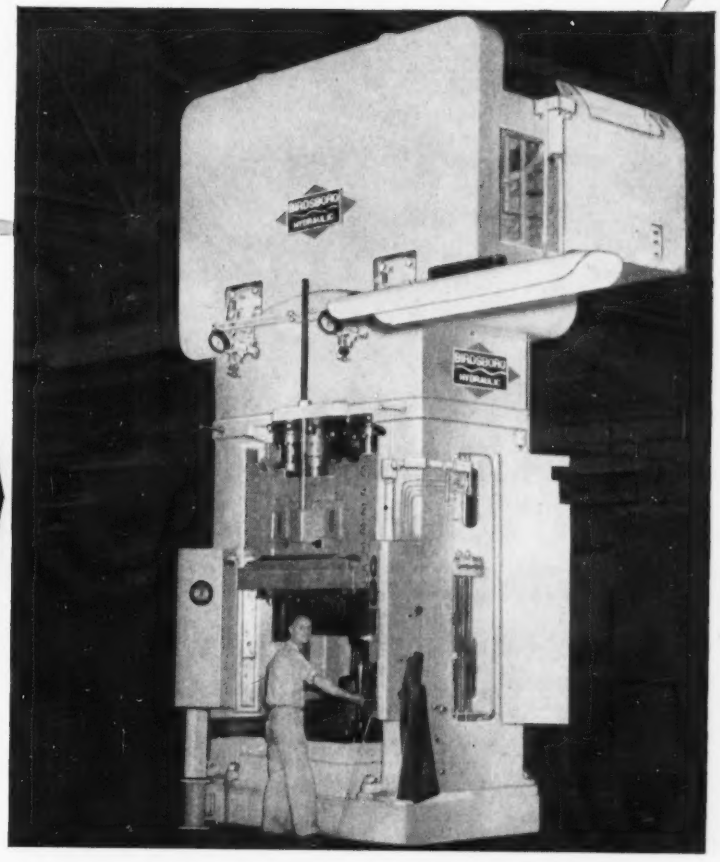
For more information on products advertised, use Inquiry Card, page 265

From "bulging" cream separator supply cans...

...to "drawing" seed hoppers for corn planters

INTERNATIONAL HARVESTER relies on a **BIRDSBORO** Hydraulic Press





Designers and Builders of:

STEEL MILL MACHINERY
HYDRAULIC PRESSES
CRUSHING MACHINERY
SPECIAL MACHINERY
STEEL CASTINGS
Weldments "CAST-WELD" Design
ROLLS: Steel, Alloy Iron, Alloy Steel

• Recognized specialization in press design enables BIRDSBORO to offer you made-to-order production help on a vast variety of products.

Whatever your products or problems, it's wise to see what BIRDSBORO can do for your plant operations.

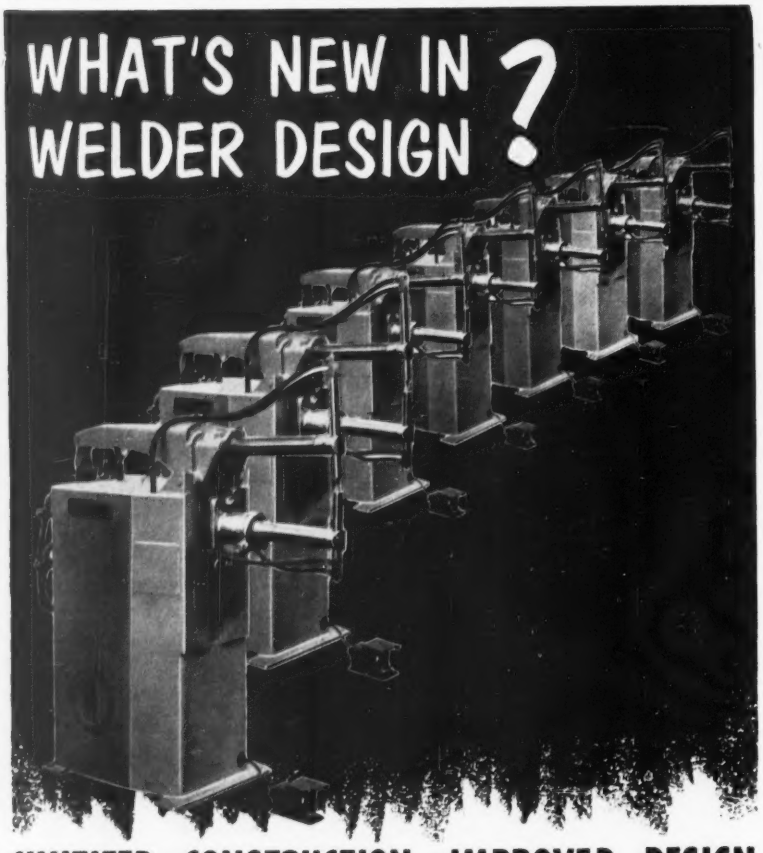
HP-16-54

BIRDSBORO

BIRDSBORO STEEL FOUNDRY & MACHINE CO., BIRDSBORO, PENNA. Offices in Birdsboro, Pa. and Pittsburgh, Pa.

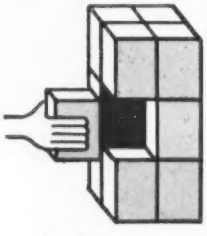
For more information on products advertised, use Inquiry Card, page 265

WHAT'S NEW IN WELDER DESIGN?



UNITIZED CONSTRUCTION, IMPROVED DESIGN of Federal's Rocker-Arm Spot Welder MEANS BETTER WELDS, FASTER, LOWER UPKEEP

UNITIZED DESIGN
A Federal Exclusive!



Component parts of each system are sectionized and mounted on individual, removable panels. Normal "down-time" is reduced to an absolute minimum; maintenance greatly simplified.

Federal's New Rocker Arm Spot Welders—redesigned from base to tip—to deliver highest production with a minimum of operating and maintenance costs. Feature for feature they are the outstanding low cost spot welders of this type available today.

Here's a few of the many features: Unitized Design, built in sections for easy maintenance and interchangeability; More Space, tapered frame permits greater working areas; Compact Construction, trims bulk—all lines are outside frame—easily accessible without unsightly and dangerous protrusions; Ferrule Fittings, with threaded couplings, permit quick, simple disconnect of all water and air connections; Low Loss Cylinder of new design boosts efficiency as does the new style Low Inertia, streamlined Horn Raising Lever. It's all new! It's welding efficiency at it's finest. It's another reason why welding engineers trust "Federal—First in Resistance Welding."

Federal® WELDERS

Warco® PRESSES

THE FEDERAL MACHINE AND WELDER COMPANY

WARREN, OHIO

SANDERS

Black & Decker Mfg. Co., E. Penna Ave., Towson, Md.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Ingersoll-Rand Co., Phillipsburg, N. J.
Jarvis, Charles L., Co., Middletown, Conn.
Keller Tool Co., Grand Haven, Mich.
Kindt-Collins Co., 12653 Elmwood Ave., Cleveland 11, Ohio.
Millers Falls Co., Greenfield, Mass.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

SAW BLADES, Hack

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Millers Falls Co., Greenfield, Mass.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S. Co., Athol, Mass.
Victor Saw Works, Inc., Middletown, N. Y.

SAW SHARPENING MACHINES

Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

SAWING MACHINES, Circular

Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.

SAWING MACHINES, Friction

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

SAWING MACHINES, Metal Cutting Band

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Boice-Crane, 941 W. Central Ave., Toledo, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Grob, Inc., Grafton, Wis.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Walker-Turner Div., Kearney & Trecker Corp., South Ave., Plainfield, N. J.

SAWING MACHINES, Power Hack

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Ryerson, Joseph T., & Son Inc. 2558 W. 16th St., Chicago 18, Ill.
Victor Saw Works, Inc., Middletown, N. Y.

SAWS, Circular Metal Cutting

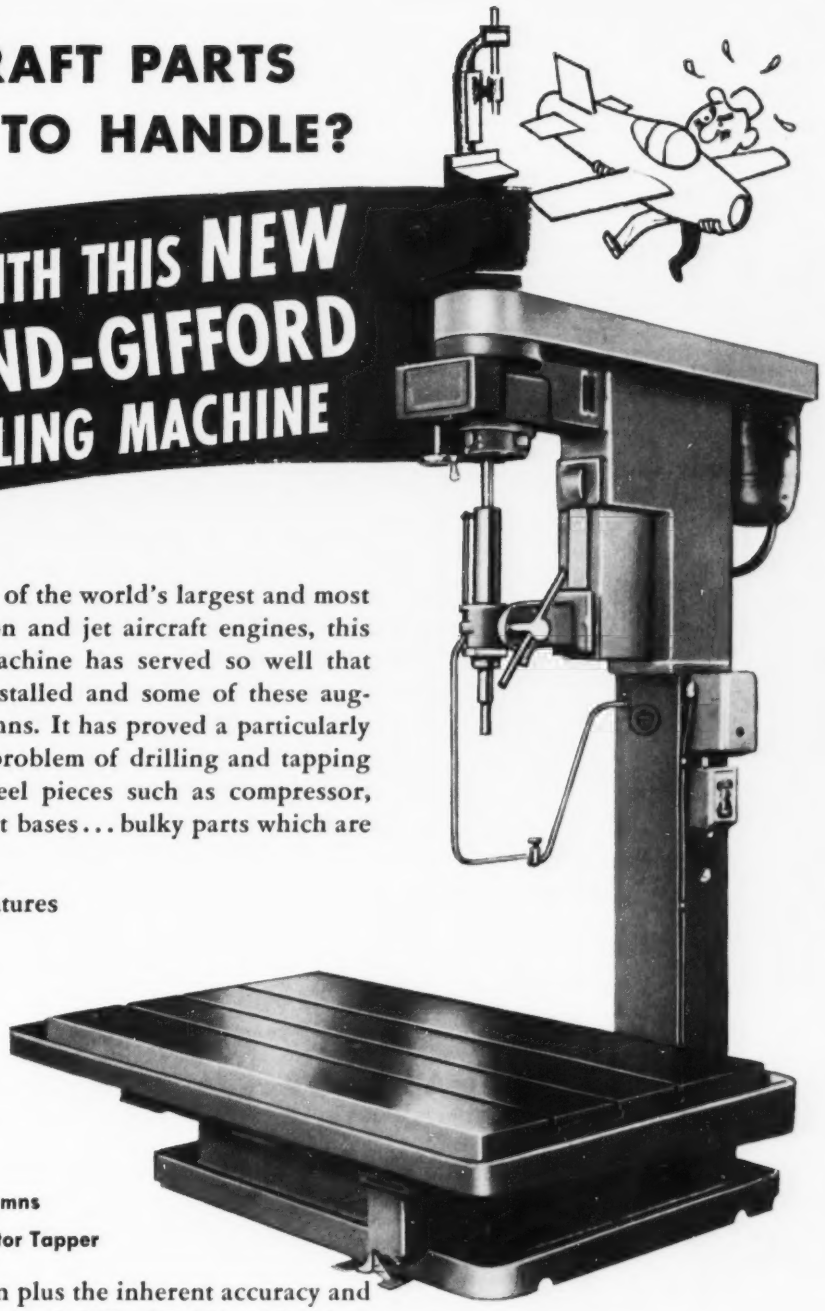
Alina Corp., 401 Broadway, New York 13, N. Y. (Portable).
Brown & Sharpe Mfg. Co., Providence, R. I.
Consolidated Mch. Tool Corp., Rochester, N. Y.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Johnson Mfg. Co., Albion, Mich.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
National Twist Drill & Tool Co., & Winter Bros., & Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Union Twist Drill Co., Athol, Mass.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

(Continued on page 410)

For more information on products advertised, use Inquiry Card, page 265

AIRCRAFT PARTS HARD TO HANDLE?

NOT WITH THIS NEW LELAND-GIFFORD DRILLING MACHINE



Developed in 1951 for one of the world's largest and most respected builders of piston and jet aircraft engines, this Leland-Gifford Drilling Machine has served so well that dozens more have been installed and some of these augmented by additional columns. It has proved a particularly successful solution to the problem of drilling and tapping large, annular, stainless steel pieces such as compressor, diffuser and turbine exhaust bases... bulky parts which are normally hard to handle.

Some of the outstanding features of this machine are:

- **24 inch Overhang**
- **Large 42 x 78 inch Platen**
- **8 Spindle Speeds from 90 to 3600 RPM**
- **Single or Multiple Spindles**
- **12 inch Spindle Travel**
- **Provision for Additional Columns**
- **Power Feed or Reversing Motor Tapper**

The flexibility of this design plus the inherent accuracy and operating ease found in all Leland-Gifford Drilling Machines make this unit a worthy addition to the drilling and tapping facilities of any plant. Why not ask your near-by Leland-Gifford sales engineer for complete information?

LELAND-GIFFORD
Drilling Machines
WORCESTER 1, MASSACHUSETTS, U. S. A.

- **CHICAGO 45**
  2515 West Peterson Ave.
- **DETROIT**
  10429 West McNichols Rd.
- **CLEVELAND 21**
  P. O. Box 217
- **NEW YORK OFFICE**
  75 South Orange Ave.
  South Orange, N. J.
- **LOS ANGELES OFFICE**
  2620 Leonis Blvd., Vernon 58, Cal.
- **INDIANAPOLIS 6**
  P. O. Box 1051
- **ROCHESTER 18**
  P. O. Box 67, Roselawn Station

For more information on products advertised, use Inquiry Card, page 265

SAWS, Metal Cutting Band

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Delta Power Tool Div., Rockwell Mfg. Co. 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Johnson Mfg. Co., Albion, Mich.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

SAWS, Portable Electric

Black & Decker Mfg. Co., Penna. Ave., Towson, Md.
Millers Falls Co., Greenfield, Mass.

SAWS, Screw Slotting

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.
Union Twist Drill Co., Athol, Mass.

SCRAPERS, Hand and Power

Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.

SCREW DRIVERS, Power

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.

SCREW DRIVING AND NUT SETTING EQUIPMENT

Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Jarvis, Charles L., Co., Middletown, Conn.
Keller Tool Co., Grand Haven, Mich.

SCREW MACHINE TOOLS AND EQUIPMENT

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Millers Falls Co., Greenfield, Mass.
National Acme Co., 170 E. 131st St., Cleveland.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
R and L Tools, 1825 Bristol St., Philadelphia 40, Pa.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW MACHINE WORK

Eastern Mch. Screw Corp., New Haven, Conn.
Mueller Brass Co., Port Huron 35, Mich.
National Acme Co., 170 E. 131st St., Cleveland.
Ottemiller, W. H., Co., York, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.
Wicaco Machine Corp., Stenton Ave., and Louden St., Philadelphia, Pa.

SCREW MACHINES, Automatic Single and Multiple Spindle

Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW MACHINES, Hand

See also Lathes, Turret

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW PLATES

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Winter Bros. Co., Rochester, Mich.

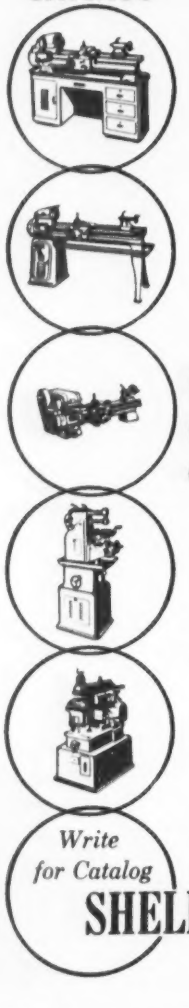
SCREWS, Cap, Set, Safety Set and Machine, Etc.

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Allied Products Corp., 12677 Burt Rd., Detroit 23, Mich.
Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only.)
Chicago Screw Co., Bellwood, Ill.

(*Continued on page* 412)

SHELDON

CHICAGO U. S. A.



OFTEN PAYS OUT ON THE FIRST JOB...

and gives additional years of "cost free" service.

In the past, lathes were generally bought as large and as heavy as possible to insure accuracy and sufficient power. Now, with accurate, low-cost Sheldon Precision lathes, it is more profitable to buy these faster, cost-cutting lathes for the specific job at hand just as you would buy jigs and fixtures.

In savings of tooling costs, operator cost, power cost, and plant loading, as well as extra profits from more pieces per hour, Sheldon lathes often pay back their cost on a single run.

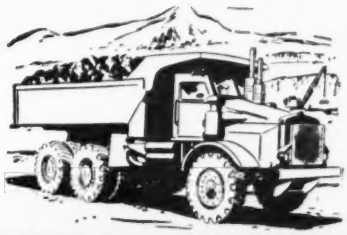
Sheldon lathes will work to the closest tolerances—have "Zero Precision" Taper Roller Bearings. They can take a healthy cut when operating at high speed direct drive—have double V-belts to the spindle. They will swing 10", 11" or 13" and have a 1⅝" hole through the spindle—have sufficient capacity for the great bulk of lathe work. Sheldon lathes have created a new factor for figuring machinery costs. They are tools you should know about.

Write for Catalog

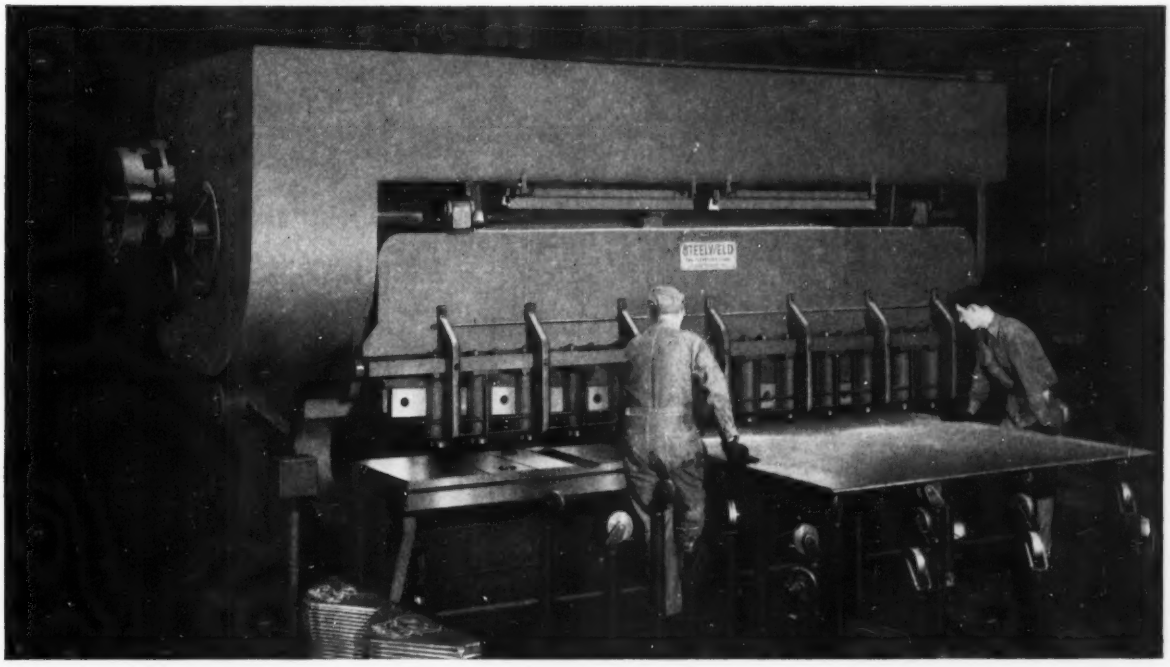
SHELDON MACHINE CO., INC.

4246 N. Knox Ave. Chicago 41, Illinois

For more information on products advertised, use Inquiry Card, page 265



Better Cuts Make Better Fits for Road Machinery Builder



This rugged machine is in service two shifts — 16 hours a day — five days a week shearing parts of various thicknesses and shapes for heavy earth-moving equipment. It is rated for mild steel 12' x 1".

THE ease with which good, square, accurate cuts are obtained has made the Steelweld Shear of a road machinery manufacturer very popular with the operators and shop management.

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(*Continued on page* 414)

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(Continued on page 416)

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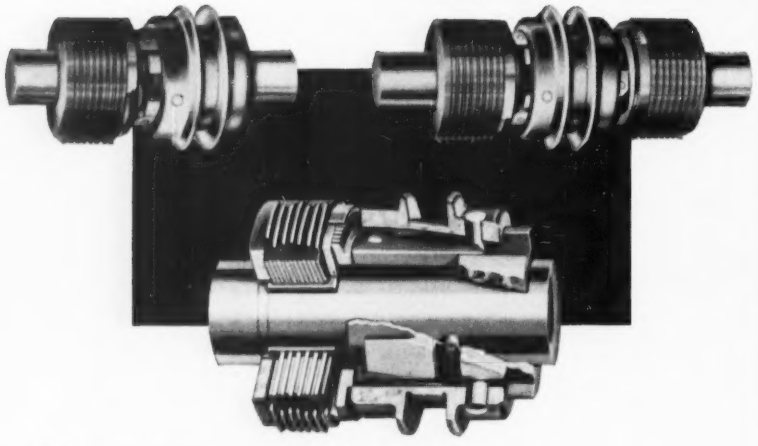

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(*Continued on page* 418)

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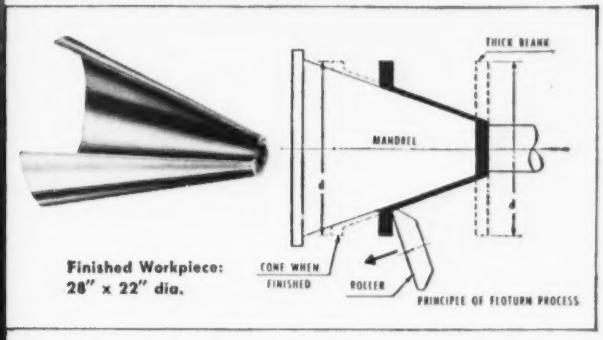

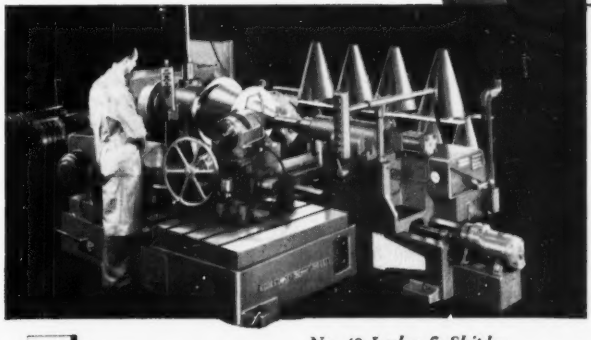

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Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Summerill Tubing Co., Div., Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp., (American Steel & Wire Co., Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, High Speed Tool

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Lincoln Hwy. & State St., Chicago Heights, Ill.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Machine

Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Stainless

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Strip and Sheet

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.

STEEL, Tool and Die

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Lincoln Hwy. & State St., Chicago Heights, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Vanadium Alloys Steel Co., Latrobe, Pa.

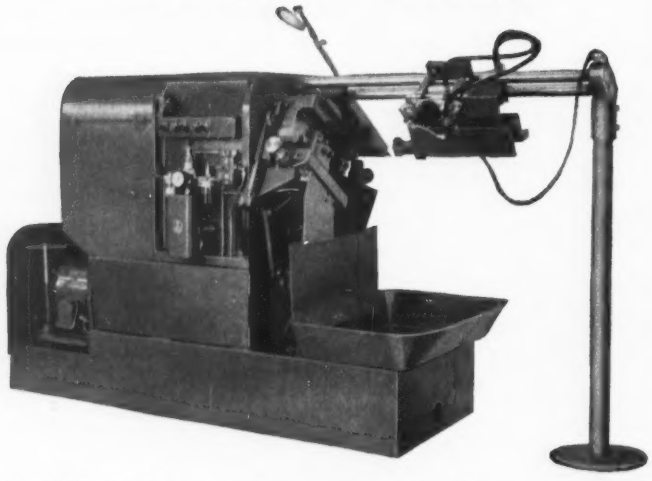
STEEL, Zinc, Tin and Copper Coated Strip

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.

STEEL ALLOYS

See Alloys, Steel
(*Continued on page* 420)

The NEW MODERN AUTOMATIC
CUTTING-OFF MACHINE



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This machine cuts off and chamfers both outside edges of 3" long, at the rate of one every 3 seconds.

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For more information on products advertised, use Inquiry Card, page 265

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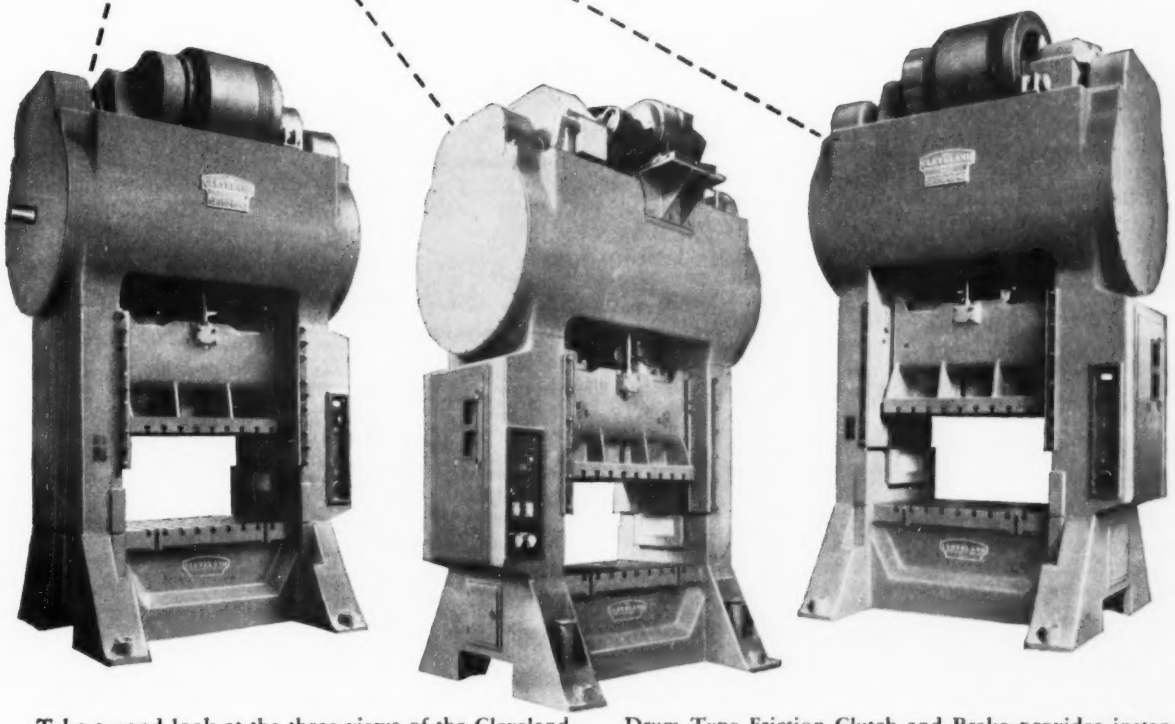

Take a good look at the three views of the Cleveland 350-ton, two-point press shown here. Check the many Cleveland design features for better operation. Most of these same features are available on all 11 types of Cleveland's complete line of presses. Study them and see why you'll profit by installing Clevelands.

RUGGEDNESS—This Cleveland features the four-piece tie-rod type of construction. The bed, crown and two uprights are securely held together by four steel tie-rods that have been heated to the correct degree and allowed to shrink into place. These rods not only hold the four sections rigidly together but take up the stress which otherwise would be transmitted directly to the frame as in one-piece type of press construction.

ACCURACY—Cleveland slides are fitted with extra long bearing surfaces. These insure accurate guidance throughout the entire slide stroke. For lasting accuracy the gibs can be adjusted to eliminate undue play between gibbing and slide-bearing surfaces.

ECONOMY—The trouble-free (patented) Cleveland Drum Type Friction Clutch and Brake provides instantaneous slide control at all times. This unit needs little maintenance and is readily accessible. Costly down-time due to clutch failure is practically eliminated. Lightweight construction and cool running design offer power savings.

SAFETY—The powerful, spring-loaded, clutch brake brings the slide to an immediate stop in event of electric or air supply failure. For added safety the flywheel is equipped with an auxiliary air brake which brings it to an immediate stop when power is shut down.

SPECIAL FEATURES—As shown here, this Cleveland is equipped with two safety blocks for use during die setting. These blocks are tied into the control circuit by safety plugs. When blocks are removed from their storage position in press base, the control circuit is made inoperative. For added convenience the die area is lighted from both sides by lights recessed in the uprights. Centralized lubrication not only assures better operation but greatly reduces maintenance-time.

A-9797

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See Bars, Steel

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Starrett, The L. S., Co., Athol, Mass.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh, Pa.

STELLITE
Haynes Stellite Div., Union Carbide & Carbon Corp. (Alloy), 30 E. 42nd St., New York, N. Y.

STOCKS, Die
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. of Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.

STONES, Oil or Sharpening
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester 6, Mass.

STOOLS
Standard Pressed Steel Co., Jenkintown, Pa.

STRAIGHTEDGES
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

STRAIGHTENERS, Flat Stock and Wire
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

STRAIGHTENING MACHINERY
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Springfield Mch. Tool Co., Springfield, Ohio.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

STUD SETTERS
Errington Mechanical Laboratory Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.

SUB-PRESSES
Waltham Machine Works, Newton St., Waltham, Mass.

SUPERFINISHING MACHINES
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.

SURFACE PLATES
See Plates, Surface

SWAGING MACHINES
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Torrington Co., Torrington, Conn.

SWITCHES
Allen-Bradley Co., 1326 S. 2nd St., Milwaukee, Wis.
Centrol Products, Inc., (Waterproof and Thermal), 306 Sussex St., Harrison, N. J.
General Electric Co., Schenectady, N. Y.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.

TACHOMETERS
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

TAPER PINS, Standard
Alimetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only).
Chicago Screw Co., Bellwood, Ill.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gillen, John, Co., Inc., 2540 S. 50th Ave., Cicero 50, Ill.
Pratt & Whitney, West Hartford 1, Conn.

TAP HOLDERS
Burg Tool Mfg. Co., 3743 Durango Ave., Los Angeles 34, Cal.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
McCrosky Tool Co., 1938 Thomas St., Meadville, Pa.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.

TAPPING ATTACHMENTS AND DEVICES
Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Baptist Machine Co., Inc., 36 Ludlow St., Stamford, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Jarvis, Chas. L., Co., Middletown, Conn.
Leland-Gifford Co., 1425 Southbridge St., Worcester, Mass.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.

TAPPING MACHINES
Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P.O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wasson Ave., Springfield 7, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport, Conn.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Challenge Mchry. Co., Grand Haven, Mich.
Cleveland Tapping Machine Co., Canton 6, Ohio.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Jarvis, Chas. L., Co., Middletown, Conn.
Kaufman Manufacturing Co., Manitowoc, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Millholland, W. K. Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

TAPPING MACHINES, Nut
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.

TAPS
Besley-Welles Corp., Beloit, Wis.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Continental Tool Works, Div. Ex-Cell-O. Corp., Detroit 32, Mich.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Iroquois Corp., RFD 4 Box 331, 1800 E. 11 Mile Rd., Royal Oak, Mich.
Landis Mch. Co. (Solid Adjustable), Waynesboro, Pa.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Winter Bros. Co., Rochester, Mich.
Wood & Spencer Co., 1930 E. 61st St., Cleveland, Ohio.

TAPS, Collapsing
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

TESTING EQUIPMENT, Tension, Compression, Fatigue, etc.
Olsen Tinius, Testing Machine Co., Philadelphia, Pa.

THREAD CUTTING MACHINERY
Brown & Sharpe Mfg. Co., Providence, R. I.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Coulter, James, Machine Co., Bridgeport 5, Conn.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Eastern Mch. Screw Corp., New Haven, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Hirschmann Co., Carl, 30 Park Ave., Manhasset, N. Y.
Kaufman Manufacturing Co., Manitowoc, Wis.
Landis Mch. Co., Waynesboro, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

THREAD CUTTING TOOLS
Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
Eastern Mch. Screw Corp., New Haven, Conn.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Mch. Co., Waynesboro, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

THREAD GAGES
See Gages, Thread.

THREAD GRINDING MACHINES

See Grinding Machines, Thread

THREAD MILLING MACHINES

Coulter, James, Machine Co., Bridgeport 5, Conn.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Waltham Machine Works, Newton St., Waltham, Mass.

THREAD ROLLING HEADS

National Acme Co., 170 E. 131st St., Cleveland, Ohio.

THREAD ROLLING MACHINES

Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.

TIN AND TERNEPLATES

Bethlehem Steel Co., Bethlehem, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

TOOL BITS, High Speed Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Besley-Welles Corp., Beloit, Wis.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Lincoln Hwy. & State St., Chicago Heights, Ill.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TOOL BITS, Special Alloy

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

TOOL GRINDERS

See Grinding Machines for Sharpening, Turning and Planning Tools.

TOOL GRINDING ATTACHMENTS

Detroit Reamer & Tool Co., 2830 E. 7 Mile Rd., Detroit, Mich.

TOOL HOLDERS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Burg Tool Mfg. Co., 3743 Durango Ave., Los Angeles 34, Calif.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
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OK Tool Co., Milford, N. H.
Portage Double Quick Tool Co., 1063 Sweitzer Ave., Akron 11, Ohio.
R and L Tools, 1825 Bristol St., Philadelphia 40, Pa.
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South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TOOLMAKERS' INSTRUMENTS

Ames, B. C., Co., Waltham 54, Mass.
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Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

TOOL STEEL

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Lincoln Hwy. & State St., Chicago Heights, Ill.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son., Inc., 2558 W. 16th St., Chicago 18, Ill.
Vanadium Alloys Steel Co., Latrobe, Pa.

TOOLS, Carbide-Tipped

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Atrax Co., Newington, Conn.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Colonial Broach Co., Detroit 13, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Kennametal, Inc., Latrobe, Pa.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Newcomer Products, Latrobe, Pa.
OK Tool Co., Milford, N. H.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

TOOLS, Lathe, Shaper and Planer

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Halpern, Wm., Co., Inc., 100 Stevens Ave., Mt. Vernon, N. Y.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
OK Tool Co., Milford, N. H.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Super Tool Co., 21650 Hoover Road, Detroit 13, Mich.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland, Ohio.

(*Continued on page 422*)

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Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

TRANSFORMERS

General Electric Co., Schenectady, N. Y.

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Link-Belt Co., 2045 W. Huntington Park Ave., Philadelphia 40, Pa.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4.
Reliance Electric & Engrg. Co., 1047 Ivanhoe Rd., Cleveland 10, Ohio.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

TUBE FLANGING MACHINES

Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.

TUBE FORMING AND WELDING MACHINES

American Elec. Fusion Corp., 2606 Diversey Ave., W., Chicago, Ill.
Yoder Co., 550 Walworth Ave., Cleveland.

TUBE MILLS

Abbey-Etna Co., 2422 Maplewood Ave., Toledo 10, Ohio.

TUBING, Brass and Copper

American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

TUBING, Flexible

American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.

TUBING, Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
National Tube Div. U. S. Steel Corp., 525 Wm. Penn Place, Pittsburgh, Pa.
Republic Steel Corp., Steel & Tubes Div., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh, 30, Pa.
Timken Roller Bearing Co., Canton, Ohio.

TWIST DRILLS

See Drills, Twist

UNIVERSAL JOINTS

Baush Machine Tool Co., 156 Wasson Ave., Springfield 7, Mass.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Gear Grinding Machine Co., 3901 Christopher St., Detroit 11, Mich.

VALVE CONTROLS

Lehigh Foundries, Inc., 1500 Lehigh Dr., Easton, Pa.
Philadelphia Gear Works (Motorized), Erie Ave. and G St., Philadelphia, Pa.

VALVES, Air

Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hunt, C. B., & Son, Inc., 1911 E. Pershing St., Salem, Ohio.
Lehigh Foundries, Inc., 1500 Lehigh Dr.. Easton, Pa.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
Rivett Lathe & Grinder Inc., Brighton, Boston 35, Mass.
Ross Operating Valve Co., 120 E. Golden Gate, Detroit, Mich.

VALVES, Hydraulic

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Baptist Machine Co., Inc., 36 Ludlow St., Stamford, Conn.
Barnes, John S., Corp., Rockford, Ill.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hunt, C. B., & Son, Inc., 1911 E. Pershing St., Salem, Ohio.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lehigh Foundries, Inc., 1400 Lehigh Dr., Easton, Pa.
Logansports Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wood & Co., R. D., Public Ledger Bldg., Philadelphia, Pa.

VALVES, Pneumatic

Baptist Machine Co., Inc., 36 Ludlow St., Stamford, Conn.

VIBRATION INSULATION

American Felt Co., Glenville, Conn.

VISES, Machine

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Homestead Inc., Larchmont, N. Y.
Logansports Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Priodocto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend. Ind.
Universal Engineering Co., Frankenmuth 2, Mich.

VISES, Pipe

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

VISES, Planer and Shaper

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

VISES, Pneumatic

Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.

VOLTMETERS

General Electric Co., Schenectady, N. Y.

WASHERS, Lock

Allmetal Screw Products Co., Inc., 821 Stewart Ave., Garden City, N. Y. (Stainless Steel only).
Eaton Mfg. Co., Reliance Div.. 25 Charles Ave., S. E., Massillon, Ohio.

WASHERS, Spring
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Linde Air Products Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

WELDING AND CUTTING GAGES
Linde Air Products Co., Div. Union Carbide & Carbon Corp., 30E. 42nd St., New York, N. Y.

WELDING EQUIPMENT, Electric Arc
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Expert Welding Machine Co., 17144 Mt. Elliott Ave., Detroit 12, Mich.
General Electric Co., Schenectady, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.

WELDING EQUIPMENT, Electric, Spot, Butt, Seam, Etc.
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Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Expert Welding Machine Co., 17144 Mt. Elliott Ave., Detroit 12, Mich.
Federal Machine & Welder Co., Warren, Ohio.

WELDMENTS
Mahon, R. C., Co., Detroit 34, Mich.
Peerless Production Corp., 19449 Glendale Ave., Detroit 23, Mich.
Woods, A. C., & Co., Div. Kropp Forge Co., 1129 Harrison Ave., Rockford, Ill.

WIPERS
Scott Paper Co., Chester, Pa.
Kimberly Clark Corp., Neenah, Wisc.

WIRE
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
U. S. Steel Corp., (American Steel & Wire Co. Div. Columbia Steel Co. Div., Tennessee Coal Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.

WIRE FORMING MACHINERY
Baird Machine Co., 1700 Strattford Ave., Stratford, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

WIRE NAIL MACHINERY
Baird Machine Co., 1700 Strattford Ave., Stratford, Conn.
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
National Mchry. Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Ryerson Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

WOODWORKING MACHINERY
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

WORM DRIVES
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Link-Belt Co., 2045 W. Huntington Park Ave., Philadelphia 40, Pa.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Erie Ave. and G St. Philadelphia, Pa.

WRENCHES
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Ingersoll-Rand Co. (Impact, Pneumatic. Electric), Phillipsburg, N. J.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

WRENCHES, Detachable Socket
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

WRENCHES, Pipe
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

WRENCHES, Ratchet
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Keller Tool Co., Grand Haven, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

WRENCHES, Tap
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.

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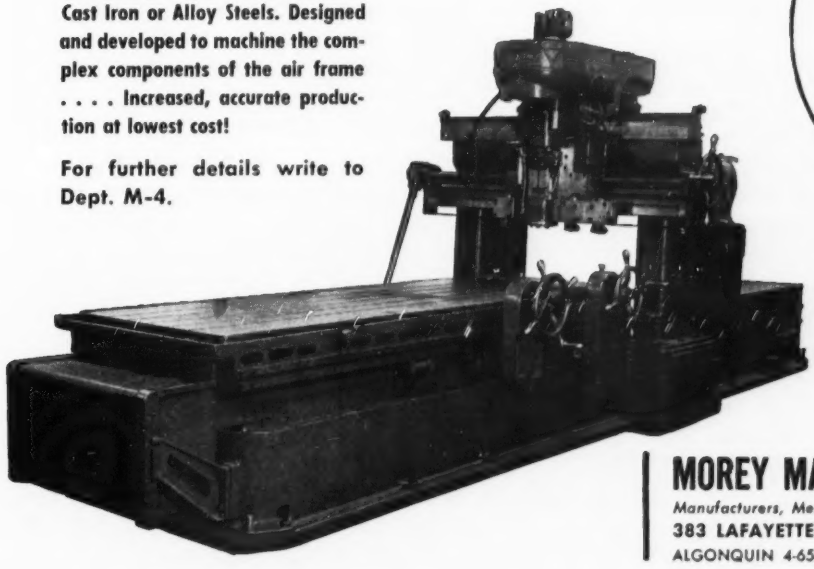

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Between housings (standard) . . . . 43"
Table lengths . . . . . 48" to 120"
Spindle . . . . . No. 50 Taper
12 speeds with 2-speed 15 HP motor.
Variations: Increased table widths and lengths.
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Single and Multiple Spindles—Vertical and Horizontal—Automatically or Foot-Operated. Handles rivets from the smallest and most delicate up to ¾" diameter.

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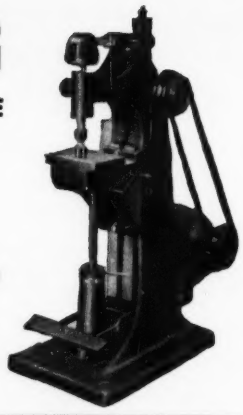

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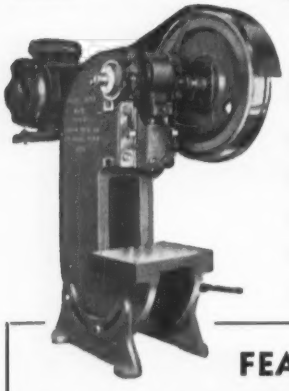
PRESS-RITE 5 Ton POWER PRESS



Compare this Press-Rite 5 Ton Power Press with any similar press on the market today and you will see why it is a better value.

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Total weight is greater with extra strength where it is most needed. Bronze flywheel bushing on standard model and roller bearings on high-production model are regular equipment. Heavy knock-out lugs . . . new heavier clutch . . . bronzed bearing in the connecting rod and main bearing . . . heavier frame . . . gib adjustments on both sides of ram . . . bronze wearplates in ramway. Yes, feature for feature, the Press-Rite 5 Ton Power Press is your best buy.

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QUICK, LOW COST OPERATION is made possible by the Davis tilting table, which permits even work tapering as much as 3" per foot to be set up and cut quickly. And Davis multiple tooth cutters make quick work of all keyways up to 1" in width. Let us work out set-ups to speed up your production.

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1-Ton Power Bench Type

$97.50 less Motor

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. . . for HIGH PRODUCTION MILLING of smaller BOX and FACE cams

Condensed Specifications no. 348

Capacity: 11" max. O.D. and ¾" max. dia. groove.
Cutter Speeds: 460–1800 rpm.
Work Feeds (with standard motor): 3½, 5¾ and 8 min. per rev.
Floor Space: 43" x 43".
Weight: 1600 lbs.

This Rowbottom Cam Miller embodies features which are the result of more than half a century's specialized experience in the design and building of machines for producing cams. It differs from other machines in the Rowbottom line in capacity, being specifically designed for producing box and face cams of smaller size. With this machine in your Cam Department, you can release larger machines for larger work and be assured of high, economical production of cams of all sizes within its capacity range.

The many features of this high production machine are described in illustrated literature available promptly on request. Write today.

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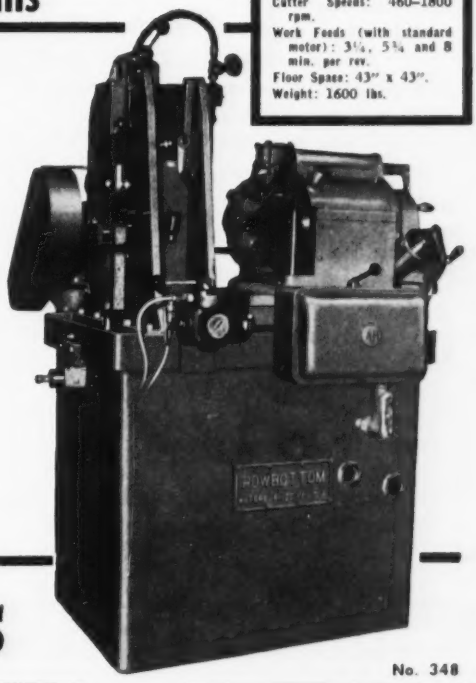
If your needs do not warrant installing cam-making machines, Rowbottom can serve you as your Cam Department by producing your requirements exactly to your specifications. Send drawings or specifications for a prompt estimate.



No. 348

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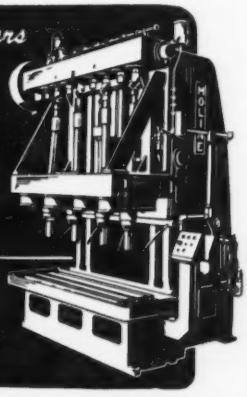
For Over 50 Years
"HOLE-HOG"
Specially Designed
MACHINE TOOLS
Have Cut Production Costs for American Industry

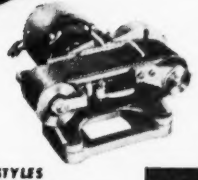


MOLINE TOOL CO.
HOLE-HOG
MOLINE, ILLINOIS

No. HU68—Hydraulic rail feed universal joint type multiple spindle drilling machine.

DOES IT BETTER... DOES IT FASTER

SIMPLEX-M
ABRASIVE BAND GRINDER



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THREAD MILLING ...AT A PROFIT!

WHEN you want smooth, accurate threads, economically cut at high production speeds—use the Waltham Thread Miller. Automatic, except for loading and unloading, it permits one operator to handle several machines. Low in first cost, low in tooling cost, low in operating cost, the Waltham Thread Miller can be used profitably to thread with precision a great variety of work. Send drawings or samples of threaded parts, and let us send you bulletins describing this and other Waltham machines.

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Newton Street
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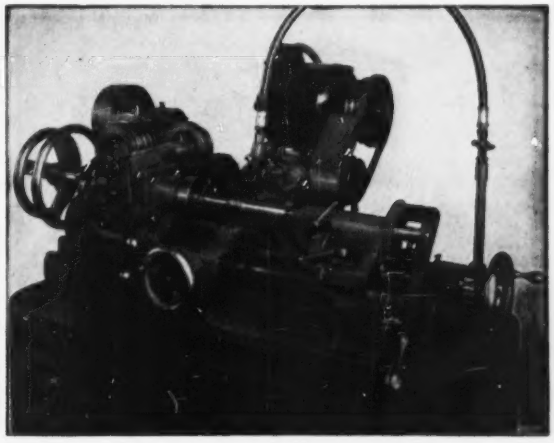
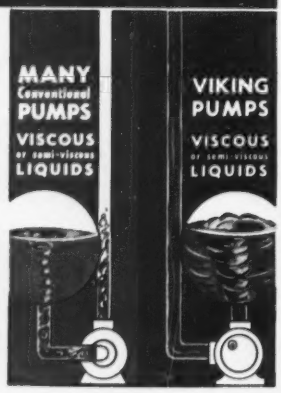


If you need POSITIVE PUMPING specify VIKING



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The Viking "gear wihin a gear" action and port design allows the material to readily enter the pump. The non-slip action of the gears forces the liquid out in steady volume.

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VIKING PUMP COMPANY
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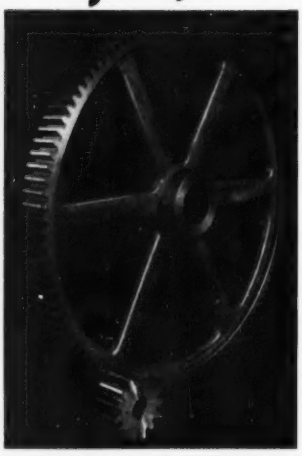

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SPURS TO 72" PD, 1 DP
BEVELS TO 54" PD, 1 DP
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M & M Giant Keyseaters, built in a wide range of sizes, speedily and accurately cut internal keyways or splines in the bores of pulleys, gears, fly wheels or any other machine part. Special fixtures and cutters are available for unusual shaped keyways and taper work. Send us your problems today.

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FLEXIBILITY AT HIGH SPEED LOW COST

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ON BORING MILLS - DRILLS - LATHES MILLERS AND RADIALS

M-D facing Head feeds automatically. Lathe tool bit travels radially from center outward or reverse. 10 sizes 4" to 46" dia. Write for bulletin, prices.

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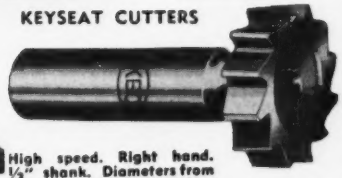
For more information on products advertised, use Inquiry Card, page 265

KEO

CENTER DRILLS

Made of finest high speed steel. Available in all standard sizes. Always in stock for immediate delivery. Specials made to your specifications.

KEYSEAT CUTTERS



High speed. Right hand. ½" shank. Diameters from ¼" to 1½". Standard sizes in stock for immediate delivery. Complete set—41 sizes—available in sturdy, hardwood box. Saves time and money, because you always have the size you need.

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High speed steel. Reamers from ¼" to 1" regularly furnished with 60°, 82° or 90° included angle. Specials made to your specifications.

LATHE MANDRELS

Precision made of tool steel, hardened and accurately ground. Tapered .0005" to the inch. Mandrels from 3/16" to 1" are .0005" undersize at small end, from 1-1/16" to 3", .001" undersize. Immediate delivery.

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PRECISION BEARINGS

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GEARS—**ALL MAKES . . .**
Special and Standard

PRECISION GEARS UP TO 200 DIAMETRAL PITCH

All Gears certified for Accuracy Quality and Fine Workmanship

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Custom Gears Exclusively

DIEFENDORF GEAR CORPORATION

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GEARS

Many times more durable than steel, Talide Metal adds years of life to the wearing edges of tools, dies, machinery and equipment.

Hard as a diamond and almost indestructible, it triples output per man and per machine.

For good service and recommendations for improving any cutting, drawing or wear-resistant application, send particulars to Metal Carbides Corp., Youngstown 7, Ohio. *Write for Catalog No. 54-G*

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"TRI·FLU·MIC"

$65.00

A direct reading micrometer for three-fluted tools

●This Tri-Flu-Mic completely overcomes the usual problems presented in measuring three-fluted tools.

It accurately measures the diameter of three-fluted end mills, taps, reamers, etc., as easily and quickly as a standard micrometer measures a square bar. Exact diameters are read directly in .001".

It also may be used to determine the true roundness of cylindrical work.

The Vee anvil is 5/16" wide. Measuring surfaces of both anvil and spindle are hardened tool steel for long accurate service. Frame and head are finished in Silver Mist chrome. Graduations are black for easy reading. Normal size range is 1/2" to 1". Other sizes as well as micrometers with tungsten carbide measuring surfaces are also available. Write for name of nearest jobber and new Tumico catalog.

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an **ACCO** product

Wilson "Rockwell"* Hardness Testers

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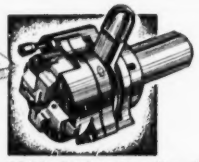

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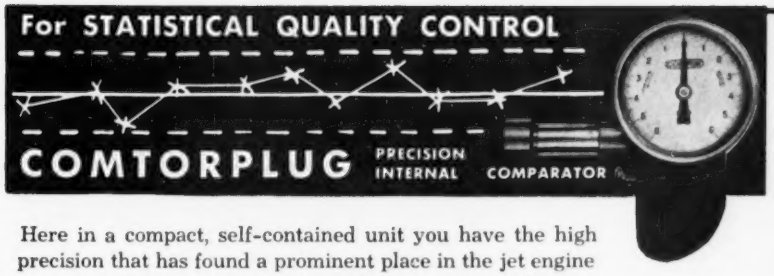

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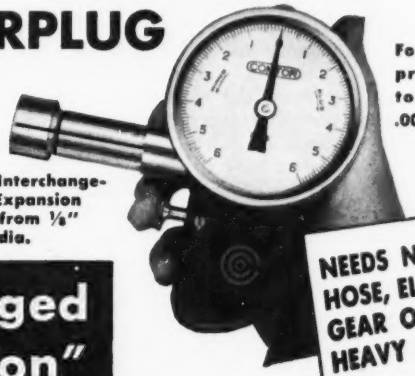

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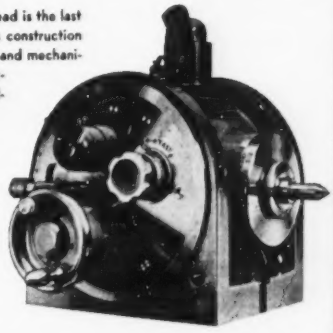

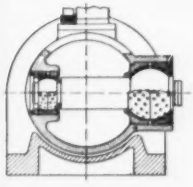

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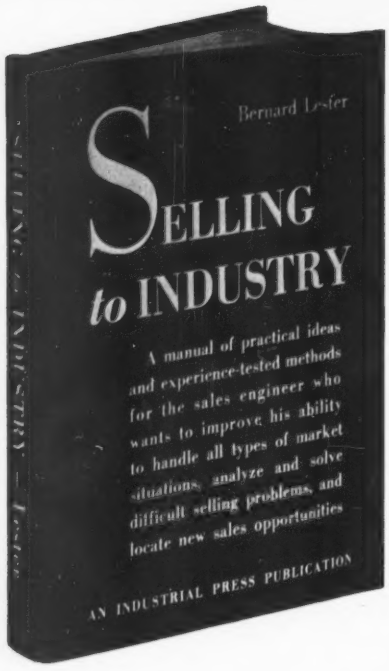
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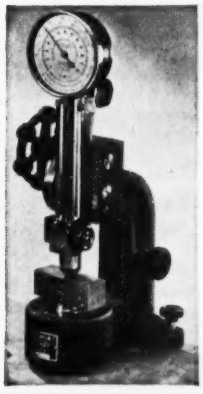

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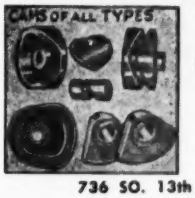

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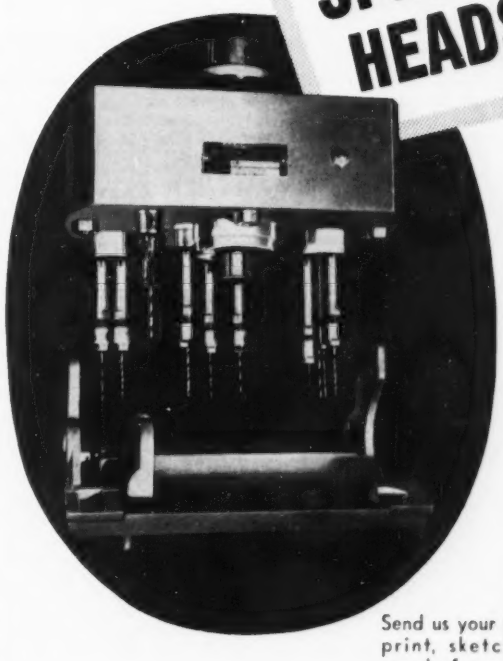

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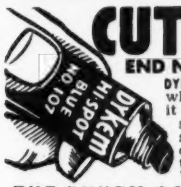

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...efficient DUST CONTROL and its recovery!

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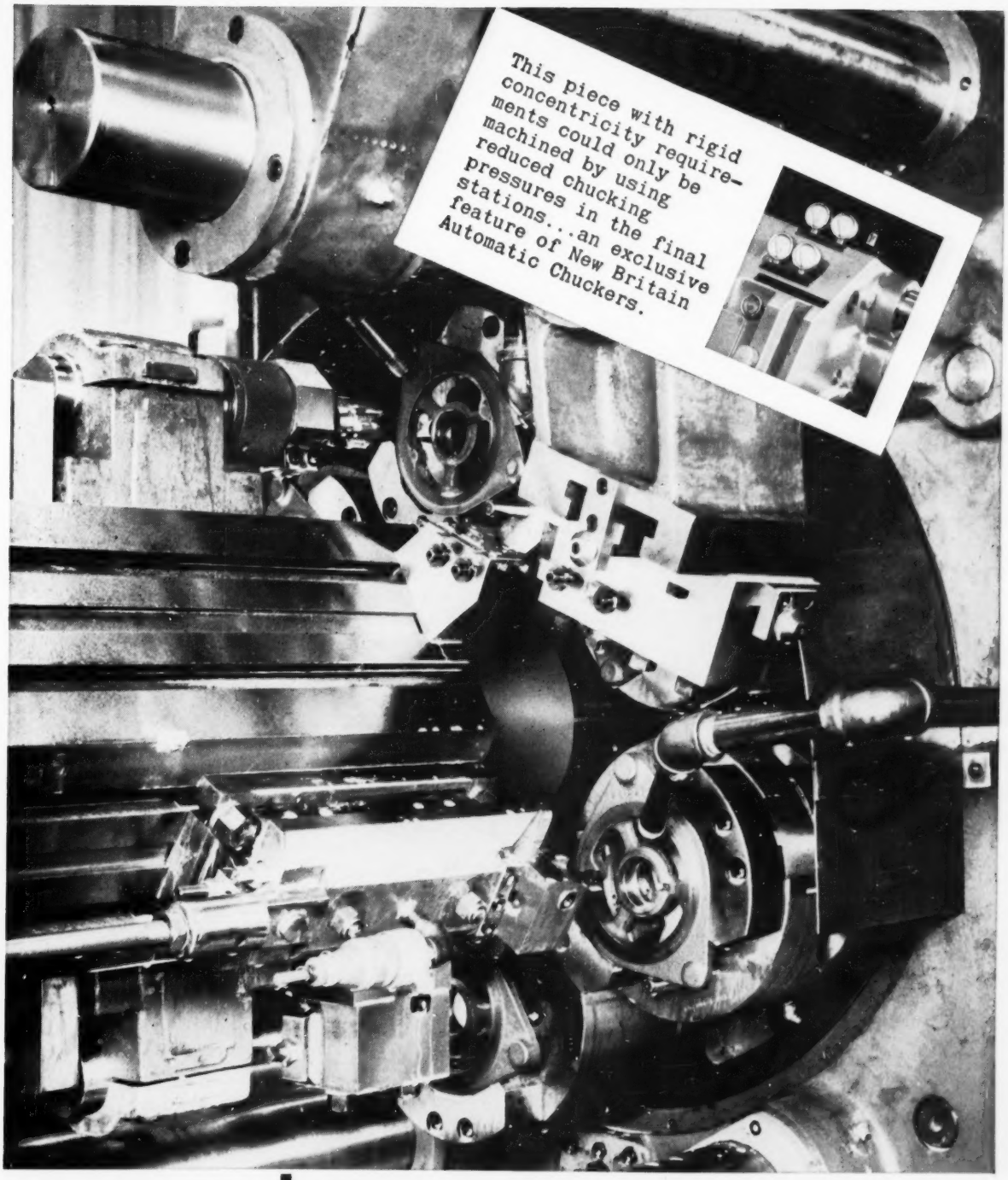

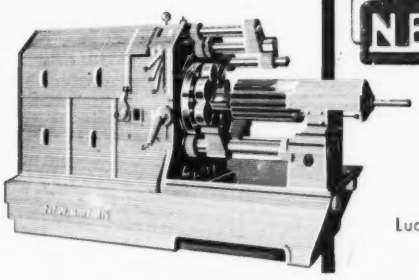

Our general catalog is filed in the Sweet's Machine Tool Catalog File.

THE NEW BRITAIN MACHINE COMPANY

New Britain-Gridley Machine Division, New Britain, Connecticut

. . . Machines for Making Progress

Automatic Bar and Chucking Machines
Precision Boring Machines
Lucas Horizontal Boring, Drilling and Milling Machines
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NEW BRITAIN *Automatics*

Achieves high production, high precision of difficult jet engine part

...with help of TIMKEN® bearings

TO insure high-speed precision machining of compressor discs for the J-34 turbo-jet engine, four Gisholt 4F Fastermatic Automatic turret lathes are set up in a two-man "production line". Each operator tends two lathes and they perform all machining in four pass-along operations.

Just what these operations are, and the time it takes, are classified information, but it's no secret that it's a particularly tough assignment. These stainless steel compressor discs have a complicated shape, and must be held to extremely close tolerances.

Gisholt makes sure these lathes operate with high precision by mounting the spindle and gear train on Timken® tapered roller bearings. The spindle has adequate capacity for any load; line contact between rollers and races of Timken bearings provides load-carrying capacity to spare. And the tapered design of Timken bearings enables them to take radial and thrust loads in any combination. This holds spindles rigid and permits pre-loading to any desired degree to prevent chatter.

Timken bearings practically eliminate friction because of their true rolling motion and smooth surface finish. Made from Timken fine alloy steel—finest steel ever developed for tapered roller bearings—Timken bearings' rollers and races are case hardened for hard, wear-resistant surfaces and tough, shock-resistant cores. As a result, wear is reduced, maintenance minimized.

Next time you buy or build a machine tool, make sure it's equipped with Timken precision tapered roller bearings. Always look for the trade-mark "Timken" stamped on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

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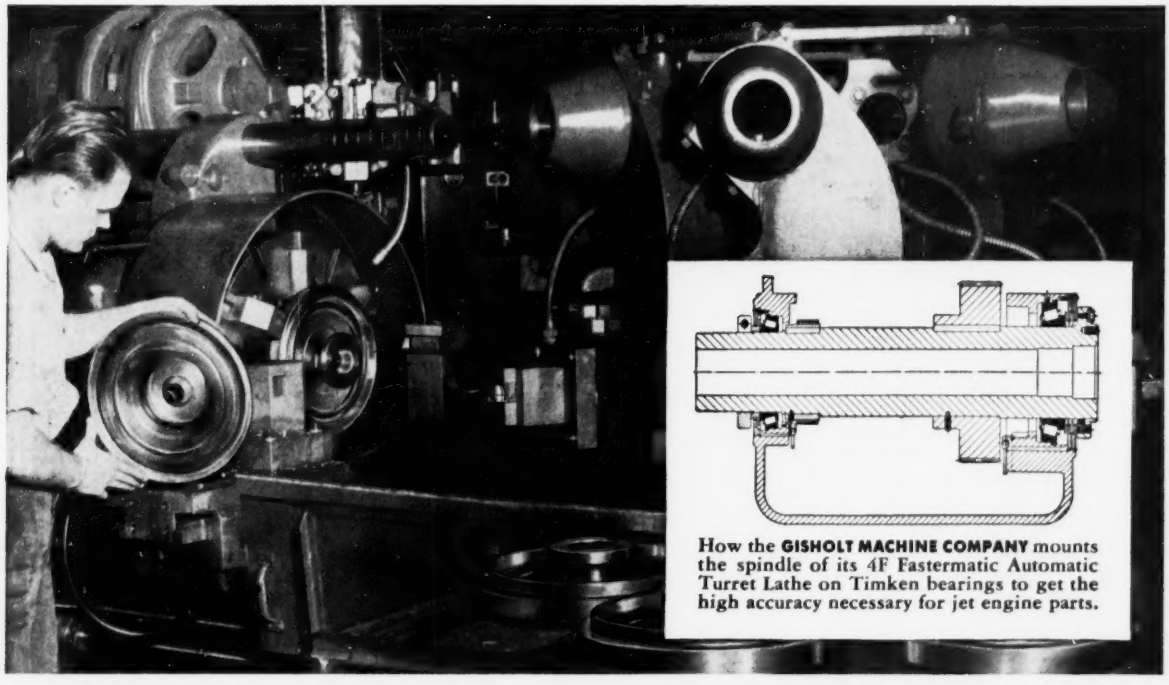
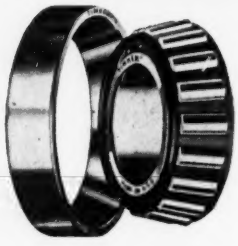


How the **GISHOLT MACHINE COMPANY** mounts the spindle of its 4F Fastermatic Automatic Turret Lathe on Timken bearings to get the high accuracy necessary for jet engine parts.



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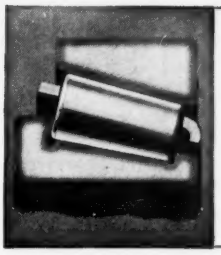

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The Timken Roller Bearing Company is the acknowledged leader in: 1. advanced design; 2. precision manufacturing; 3. rigid quality control; 4. special analysis Timken steels.

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